



United States Department of the Interior

FISH AND WILDLIFE SERVICE



Klamath Basin National Wildlife Refuges
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Dear Interested Party:

August 6, 2003

Enclosed is a copy of the *Finding of No Significant Impact* along with a Refuge Compatibility Determination associated with the *Klamath Marsh National Wildlife Refuge - Fire Reduction and Wildlife Habitat Enhancement Project Final Environmental Assessment*.

The U.S. Fish and Wildlife Service has selected Alternative 2, utilizing manual/mechanical thinning and prescribed fire, as the preferred method of reducing the fire hazard and enhancing forested and forest/meadow edge habitats on up to 3,400 acres on the Klamath Marsh National Wildlife Refuge. Other alternatives analyzed were the no action alternative, implementing thinning and prescribed fire treatments without detailed considerations for enhancing wildlife habitat and reducing the fire hazard and enhancing wildlife habitats using only manual and mechanical treatments.

In response to comments received on the Draft Environmental Assessment, Appendix 1 of both the Final Environmental Assessment and the Compatibility Determination has been developed and co-ordinated amongst several interested parties to more fully describe the desired future wildlife habitat conditions associated with the different habitat types found on the Refuge that will be realized by implementing the proposed action. The Klamath Basin Refuges greatly appreciates the input of those who participated.

If you have any questions, feel free to inquire.

Sincerely:

Ron Cole
Refuge Manager

U.S. FISH AND WILDLIFE SERVICE

Finding of No Significant Impact

Klamath Marsh National Wildlife Refuge - Fire Hazard Reduction and
Wildlife Habitat Enhancement Project

Klamath Marsh National Wildlife Refuge
Klamath Basin National Wildlife Refuge Complex
4009 Hill Road
Tulelake, CA 96134

The U.S. Fish and Wildlife Service proposes to:

The U.S. Fish and Wildlife Service proposes to reduce the fire hazard and enhance forested and forest/meadow edge habitats on up to 3,400 acres in the Klamath Marsh National Wildlife Refuge with manual/mechanical thinning and prescribed fire. Excessive tree densities and large accumulations of down woody fuels have dramatically increased the risk of catastrophic wildfire, which could threaten residences and structures in and adjacent to the refuge. These same conditions have also degraded forested and forest/meadow edge habitats required by focal wildlife species and threaten existing mature conifer stands. Once fuel hazards are reduced, prescribed fire will be used on a rotational basis to keep fuel loads to acceptable levels, re-introduce an important ecological force needed to maintain desired refuge habitats, and move the stand composition toward more fire tolerant species. The Service proposes to accomplish some thinning treatments via commercial contracts.

The Service has analyzed a number of alternatives to the proposal, including the following:

1. No Action – hazardous fuel treatments not performed (status quo management);
2. Thinning and prescribed fire treatments to reduce fire hazard while enhancing wildlife habitat (Preferred Alternative);
3. Thinning and prescribed fire treatments to reduce fire hazard without wildlife habitat considerations; and
4. Thinning treatments only to reduce fire hazard with wildlife habitat considerations.

The proposal was selected over the other alternatives because:

A combination of manual/mechanical thinning and prescribed fire consistent with needed

wildlife habitat restoration would provide the greatest degree of fire hazard reduction while still providing for high-quality wildlife habitat such as calving and fawning areas for big game and habitat for focal forest bird species. This alternative will require the assistance of the Klamath Tribes to help design site-specific treatments and to ensure that cultural resource sites are protected.

Implementation of the preferred alternative would be expected to result in the following environmental and socioeconomic effects:

Environmental

1. Big game species would be temporarily displaced during fire hazard reduction treatments; however, the availability and palatability of forage will likely improve.
2. Forest vegetation would shift toward a more fire-tolerant, shade-intolerant set of species; i.e. ponderosa pine.
3. Ponderosa pine forest communities would be restored and maintained after thinning and prescribed fire treatments.
4. Dry and wet meadows would be enhanced after treatments to remove encroaching lodgepole pines.
5. The development of aspen stands would be promoted after treatments to remove encroaching lodgepole pines.
6. Thinning and prescribed fire may temporarily displace some wildlife individuals, but not threatened and endangered species.
7. Soils on the refuge would be enriched from high-frequency, low-intensity prescribed fires.
8. Key habitats for focal forest bird species will be enhanced.
9. Potential loss of bald eagle nest and roost trees will be reduced.

Socioeconomic

1. By reducing the wildfire threat, safety and protection of public and private property on and adjacent to the refuge would be enhanced.
2. Prescribed fire may negatively impact air quality during periods of burning.
3. The local economy would receive some revenues from the commercial timber sales and contract thinning projects.
4. Fire hazard reduction activities may inconvenience tribal members since access to those areas being treated may be temporarily restricted (for safety reasons); however, treatment activities will not prevent the Tribes from exercising their Treaty rights on the refuge.

Measures to mitigate and/or minimize adverse effects have been incorporated into the proposal. These measures include:

Fire Management Activities

1. No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 30% where handline construction takes place;
2. All sites where improvements are made will be rehabilitated to pre-fire conditions, to the extent practicable;
3. Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;

Soil, Water Resources, and Vegetation

1. Stream crossings will be limited to set and existing locations;
2. No improvements will be made to intermittent waterways or clearings in forested areas;
3. Fire lines will be located outside of highly erosive areas, steep slopes, intermittent streams, riparian areas, and other sensitive areas;
4. Fire retardants and foams will not be used in riparian areas;
5. Mechanical thinning (large equipment) will be prohibited within 100 feet of intermittent streams and steep slopes (>35% slope);
6. Mechanical equipment will be restricted in operations to dry, frozen, or snow-covered ground (<20% soil moisture);
7. Slash generated from mechanical thinning activities would be spread on the pathways of the equipment to minimize soil compaction.

Wildlife

1. During the bald eagle nesting season (January 1 -August 15), fuels treatment activities and prescribed fire will not be allowed within ½ mile of active eagle nests. The refuge will consult under Section 7 of the Endangered Species Act to ensure that potential effects to listed species are minimized.
2. Backing fires would be used when possible to limit smoke production. All burns would be aggressively mopped-up. Burn prescriptions would be written to minimize the potential for high-intensity fire and to avoid severe drought and/or high wind conditions.
3. To protect mule deer and elk calving and fawning grounds, thinning and prescribed fire activities will be prohibited in these areas between May 15 and July 15. The Fish and Wildlife Service will identify the areas to be avoided during this time frame by consulting with the Oregon Department of Fish and Wildlife and the Klamath Tribes.

Transportation

1. Road improvements will be made as necessary to repair damage to the access roads resulting from vehicle use associated with thinning operations.

Cultural Resources

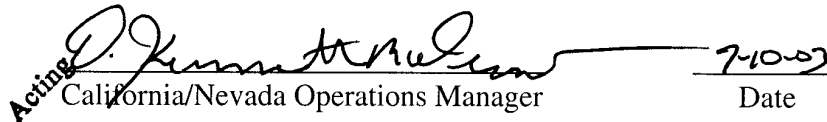
1. Prior to all thinning and prescribed fire activities, cultural resources in treatments areas will be identified and avoided;
2. If unrecorded cultural resources are discovered during thinning and prescribed fire activities, all work in the immediate vicinity of the cultural resource will stop until a Fish and Wildlife Service Archeologist and Klamath Tribal Archeologist surveys and records the location.

The proposal is not expected to have any significant effects on the human environment because:

The treatment area is relatively small (3,400 acres); hazardous fuel treatments would be conducted consistent with the mitigation measures referenced above; and public safety and protection of private property will be enhanced.

Therefore, it is my determination that the proposal does not constitute a major Federal action significantly affecting the quality of the human environment. As such, an environmental impact statement is not required. A environmental assessment has been prepared in support of this finding and is available upon request to the FWS facility identified above.

Reference: Klamath Marsh National Wildlife Refuge - Fire Hazard Reduction Wildlife Habitat Enhancement Project

 7-10-03
Active California/Nevada Operations Manager Date

U.S. FISH AND WILDLIFE SERVICE

Environmental Action Memorandum

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA) and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and have determined that the action of:

Manual/mechanical thinning and prescribed fire treatments at Klamath Marsh National Wildlife Refuge to reduce wildfire hazard and enhance wildlife habitat

is found not to have significant environmental effects as determined by the attached Environmental Assessment and Finding of No Significant Impact.

Other supporting documents:

Class III Cultural Resources Survey, D. L. Zerga & Associates

Letters of project support:

The Klamath Tribes, Natural Resource Department, dated January 13, 2003

The Klamath Tribes, Culture and Heritage Department, dated March 11, 2003

Recommended:

(1) Francis B. Mass, acting 6/16/03
Project Leader Date

(2) David G. Paulin 6/25/03
Refuge Supervisor Date

Acting [Signature] 7/1/03
California/Nevada Operations Manager Date

**Klamath Marsh
National Wildlife Refuge
Fire Hazard Reduction and
Wildlife Habitat Enhancement
Project
Final Environmental Assessment
March 21, 2003**



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Coordination and Consultation

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Glossary

Appendix 1. Desired Upland Habitat Conditions and Treatment/Restoration Options - Klamath Marsh NWR

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Chapter 1 - Purpose and Need

1.1 INTRODUCTION AND BACKGROUND

This Environmental Assessment (EA) documents the results of a study of the potential environmental effects of actions proposed by the U.S. Fish and Wildlife Service to reduce the fire hazard and enhance upland wildlife habitats at Klamath Marsh National Wildlife Refuge.

This EA has been prepared in compliance with:

- The National Environmental Policy Act (NEPA) of 1969 (42 United States Code (USC) 4321 et seq.), which requires an environmental analysis for major Federal Actions having the potential to impact the quality of the human environment;
- Council of Environmental Quality Regulations at 40 Code of Federal Regulations (CFR) 1500-1508, which implement the requirements of NEPA;
- US Fish and Wildlife NEPA Policy Handbook (550 FW 1)
- National Wildlife Refuge System Improvement Act, 1997

The Purpose of an Environmental Assessment (EA)

An EA study is performed by a Federal agency to determine if an action they are proposing to implement would significantly affect any portion of the environment.

The intent is to provide project planners and Federal decision-makers with relevant information on a Proposed Action's potential impacts to the environment.

If the study finds no significant impacts, then the agency can publish a Finding of No Significant Impact (FONSI) and can proceed with the action. If the study finds there would be significant impacts, then the agency must prepare and publish a detailed Environmental Impact Statement to help determine how to proceed with the action.

Key objectives of NEPA are to help Federal agency officials make well-informed decisions about agency actions and to provide a role for the general public in the decision-making process. The study and documentation mechanisms associated with NEPA seek to provide decision-makers with sound knowledge of the comparative environmental consequences of the several courses of action available to them. NEPA studies, and the documents recording their results, such as this EA, therefore focus on providing input to the particular decisions faced by the relevant officials. In this case, the Manager of the Klamath Basin National Wildlife Refuge Complex is faced with a decision as to what, if anything, the Fish and Wildlife Service should do to reduce the fire hazard and enhance upland wildlife habitats at Klamath Marsh National Wildlife Refuge, as described below. This decision will be made within the overall management framework already established in the Klamath Basin National Wildlife Refuge Complex Wildland Fire Management Plan and the Klamath Marsh National Wildlife Refuge Management Plan, and consistent with the treaty rights of the Klamath Tribes. The Fire Management Plan establishes overall rules and guidance for fire management-related actions taken within the refuge, while the Management Plan establishes recreation and natural/cultural resource goals and

objectives. Therefore, the alternative courses of action considered in this EA were crafted to be consistent with the concepts established in both reports.

1.1 Background

The Klamath Marsh National Wildlife Refuge is one of 6 refuges that comprise the Klamath Basin National Wildlife Refuge Complex in south central Oregon and north central California. Klamath Marsh is located approximately 50 miles north of Klamath Falls (see Figure 1-1). Winema National Forest and private lands border the refuge. It is located in a rural setting where adjacent and nearby farms and ranches provide for cattle grazing and grass hay production.

The refuge was established in 1958 to provide migration and production habitat for migratory birds, particularly waterfowl and sandhill cranes. The refuge consists of 40,776 acres, with approximately 90% classified as permanent and seasonal marsh. Ponderosa pine and lodgepole pine forest communities occur on approximately 3,400 acres on the refuge. The refuge is one of several important locations in the Klamath Basin for migrating waterfowl, and serves as a staging area for migrating sandhill cranes. There are several bald eagle nests within the refuge and in adjacent Forest Service lands.

Refuge goals include the following:

- manage for the conservation and recovery of endangered, threatened, sensitive species and the habitats on which they depend;
- provide and enhance habitat for fall and spring migrant waterfowl;
- protect native habitats and wildlife representative of the natural biological diversity of the Klamath Basin; and
- provide high quality wildlife-dependent visitor services which are compatible with refuge purposes and cultural resource protection.

1.2 PURPOSE AND NEED

The U.S. Fish and Wildlife Service proposes to implement a plan to reduce the fire hazard and enhance wildlife habitats on approximately 3,400 acres within the Klamath Marsh National Wildlife Refuge. The objectives of the plan are to:

- provide a margin of protection to refuge structures and neighboring residences from future wildfires; and
- restore and maintain the health of wildlife habitats including open mature ponderosa pine stands, aspen, and forest/meadow edge habitats.

The existing high fire hazard on the refuge is the result of fire exclusion and vegetation management by commercial logging, circa 1920-1970. As a result of fire suppression efforts over the past 80 years, the refuge contains overly dense stands of ponderosa pine (*Pinus ponderosa*) and lodgepole pine (*Pinus contorta*). These stands, in conjunction with equally high levels of woody debris on the ground and accumulated brush, pose a high fire hazard to refuge

structures and those residences adjacent to and nearby the refuge. Not only have these conditions led to high fire hazards and placed forest health in jeopardy, they have also affected forested wildlife habitats:

“Vegetation of the East-Slope Cascades has changed in the last 150 years since European settlement of the region. Primary changes have been the loss of old forest habitat due to intensive timber harvesting, and the degradation of habitats (eg., Ponderosa pine forest) from a number of factors including fire suppression, over-grazing, invasion of exotic vegetation, and human development. The loss and alteration of historic vegetation communities has impacted landbird habitats and resulted in species range reduction, population declines, and some local and regional extirpations.” (Altman 2000).

1.2.1 *Human Health & Safety*

There are approximately 11 residences and structures within and adjacent to the refuge (one-mile radius). The structures are primarily located in the east and southeast east borders of the refuge. By reducing fuel loads and densities, and creating new and reinforcing defensible space, the Fish and Wildlife Service would reduce the risk of catastrophic wildfire to refuge structures and private property (including structures) by:

- minimizing the potential of high-severity ground or crown fires entering or leaving the refuge;
- reducing the potential for firebrands (embers carried by the wind in front of the wildfire) impacting the refuge. Research indicates that flying sparks and embers (firebrands) from a crown fire can ignite additional wildfires as far as 1 ¼ miles away during periods of extreme fire weather and fire behavior (McCoy et al., 2000);
- improving defensible space in the immediate areas for suppression efforts in the event of wildland fire.

1.2.2 *Forest Health*

Forest health refers to the condition in which all the components of a forest (the plants, the animals, the soil, water and nutrients, i.e. the ecosystem) are interacting (growing, feeding, reproducing, dying) in a reasonably stable, self-sustaining pattern that maintains productivity and diversity appropriate to the location and climate, and which can renew itself and recover from various disturbances as necessary, while meeting current and future desired levels of uses, and products for people (Dahms and Geils, 1997).

A person can be in less than optimum health with a condition such as high blood pressure, obesity or many other conditions, yet can carry on a reasonably normal life. Similarly a forest ecosystem can “function” insofar as trees grow and various animals inhabit it, but the species and

number of trees, their sizes and densities on the ground, and the numbers and diversity of species of animals living there may be very different from a normally functioning, healthy forest system.

It is well documented that overstocked forest stands yield trees that are stressed and in poor health because of increased competition for resources, particularly in drought years. Such conditions can increase tree susceptibility to disease and insect attack (McCambridge and Stevens, 1982, Fiddler et. al. 1989, Patterson, 1992).

1.2.3 Existing Conditions

Fire plays an important role in maintaining healthy ponderosa pine and lodgepole pine forest communities in the northwest. Wildfires in ponderosa pine communities historically consumed the grassy and other herbaceous vegetation on the forest floor, along with the dead branches, needles, fallen trees and seedlings, while leaving the mature trees largely unharmed. The result was a forest community that was rather open and park-like, with very few young trees or seedlings growing among the grassy vegetation on the forest floor. Lodgepole pine forest communities are characterized by infrequent but high severity fires, oftentimes resulting in stand replacement where a majority of the forest stand is killed. While specific research on the fire regime of the refuge has not been conducted, fire regimes of the Williamson River Watershed have been established and are applicable to the forested lands on the refuge. The fire regime of ponderosa pine is characterized by frequent, low-severity fires with a fire return interval of 5-15 years. The fire regimes of lodgepole pine are characterized by variable frequency, mixed-severity fires and infrequent, high-severity fires, depending on the location of the pine stands. Those stands located in riparian areas or in savannas have the former fire regime with a fire return interval of 15-50 years. The remainder of the lodgepole pine stands in the watershed have the latter fire regime with a fire return interval of 50-150 years (Williamson River Watershed, 1999?).

Beginning around 1920, wildfires were actively suppressed in and around the refuge. The result has been ponderosa pine stands that have grown up in the absence of natural, low-severity, frequent fires for many decades. Without frequent fires to kill seedlings, many have survived to form dense stands of trees crowding and interfering with each others' growth. Tree densities within ponderosa pine stands of the Refuge range from 200 - 800 stems/acre (average ~500 stems/acre), with an average basal area of 150 ft²/acre (Kilbury, 2002). High fuel loads in these overly dense stands can also be attributed to the dead woody material on the forest floor, along with masses of often intertwined dead branches still on the tree trunks. These "ladder fuels" can help flames climb from the forest floor up to the crowns of the trees. Although still alive and somewhat naturally moist, conifers' crowns can ignite and burn intensely under the right conditions. When trees are close together as they are in many parts of the refuge, fire in tree crowns can spread rapidly from tree to tree. In forest communities where the historic role of fire has been altered, and where high fire hazard exists, high-severity wildfires can occur that oftentimes result in stand replacement. The Fish and Wildlife Service proposes to reduce surface fuels ponderosa pine stands to approximately 6-10 tons/acre.

The lodgepole pine stands in the refuge have excessive woody debris on the ground in the wake of fire suppression efforts. As with the ponderosa pine, these surface fuels contribute to the high fire hazard in the lodgepole pine stands. Average estimates of surface fuels in the stands are 22 tons/acre (Goheen, 2002b).

1.2.4 *Desired Conditions*

The Fish and Wildlife Service's objectives are to provide a margin of protection to neighboring residences and private property from future wildfires and help restore and maintain the health forested wildlife habitats (See Appendix 1 for desired upland habitat conditions). A reduced fire hazard condition would be one in which refuge lands have sufficiently low fuel loading and tree spacing to prevent large, high-severity fires from spreading into or out of the refuge, reduce the potential of firebrand ignitions, reduce the potential for crown fires, or slow down a fires' progress sufficiently to allow firefighters an opportunity to suppress it. Land management agencies have several tools at their disposal to reduce fuel loadings, modify vegetation configurations in the wildland urban interface and other fire-prone areas, and provide defensible areas from which firefighters can manage and suppress wildfires. These include manual and mechanical fuel treatments (removal of woody fuels), and prescribed fires and wildland fire use (consumption of woody fuels). It is important to note that while lower tree densities and lower fuel loadings reduce the potential of large, high-severity and/or crown fires, they do not eliminate the potential of all wildland fires.

Thinning treatments and the re-introduction of fire through prescribed fire (broadcast burning) would help maintain low fuel loadings and tree densities, and would restore the natural low-severity fire regime characteristic of most of the Refuge's forested habitats. Forests with lower fuel loadings and lower tree densities will generally be closer to the naturally occurring forest structure and will be healthier as functioning ecosystems. Limited prescribed fire applications in meadows with encroaching lodgepole pine will help stop and/or reverse the encroachment. The refuge recognizes, however, that stand replacement fires in lodgepole pine is characteristic of its fire regime. It is important to note that silvicultural treatments to reduce fuel loadings and reduce densities of small diameter trees as well as prescribed fire are important habitat management tools required to sustain much of the Refuge's forested and forest/meadow edge habitats in a more natural condition thereby increasing the areas biodiversity.

1.3 DECISION TO BE MADE

Based on the analysis documented in this EA, including public comments in response to scoping, the Manager, Klamath Basin National Wildlife Refuge Complex, will decide whether or not to authorize implementation of one or more of the management alternatives developed for this proposed project. The decision will include:

- Thinning methods to be used, such as manual and/or mechanical methods;
- Prescribed fire methods to be used, such as broadcast burning and/or slash pile burning, and if so, to what extent; and

- Mitigation and monitoring measures to employ to reduce the risk of environmental harm.

1.4 SCOPING ISSUES AND IMPACT TOPICS

On November 16, 2001, a scoping notice describing the Proposed Action was sent to a mailing list of 47 individuals, agencies, organizations, and media outlets. The major issues and concerns that came from public input (e.g. email, written correspondence) were evaluated and sorted. Issues determined to be general or significant were those related to the effects of the proposed action, and those not already adequately addressed by laws, regulations, and policies. Significant issues were considered in developing and evaluating the alternatives to the Proposed Action discussed in this EA.

1.4.1 Significant Issues

- Issue: Prescribed fires (broadcast burns) may escape or spot outside of control lines and/or discharge too much smoke, thus having the potential to impact human health and safety.
- Issue: Proposed actions could result in the loss or destruction of cultural resources and artifacts that ring the Klamath Marsh.

1.4.2 General Issues

- Issue: Some woody debris should be left on site to provide wildlife habitat and contribute to soil development and nutrient cycles.
- Issue: Threatened and endangered species should be protected during fuel treatments.
- Issue: Thinning treatments in the northern portions of the refuge could adversely affect calving and fawning areas for mule deer and elk.
- Issue: Habitat for wildlife should be increased.
- Issue: Decadent lodgepole pine stands benefit some wildlife species, such as the black-backed and three toed woodpeckers, and logging would not be beneficial to these species.
- Issue: Bald eagles nesting in or near treatment units 4,5,7,8,9 could be adversely affected by proposed actions.
- Issue: The environmental assessment should discuss the cumulative impacts from pesticide applications and all logging, haying, grazing activities in the region.

- Issue: The environmental assessment should disclose the number and characteristics of the residences and structures adjacent to the refuge.
- Issue: Prescribed fire would be acceptable to reduce the fire hazard in the area and to combat noxious weeds.
- Issue: Thinning and prescribed fire activities on the north end of the refuge could adversely impact Tribal hunting by displacing animals off the refuge and out of the established Treaty Rights Area.

1.4.3 Issues Considered but not Evaluated in this Environmental Assessment

- Issue: The removal of trees greater than 14" Diameter Breast Height (DBH) should be prohibited since they provide essential roost habitat for the bald eagle. This issue was considered but not evaluated further because the proposed action limits thinning activities to trees less than 14" DBH.
- Issue: Thick pockets of trees (clumps) are within the historic range of variability and should be preserved. This issue was considered but not evaluated further because the proposed action calls for preserving ½-2 acre clumps of untreated areas scattered randomly.
- Issue: Fuel breaks should not be a component of the proposed action since numerous studies demonstrate that they do not contain wildfires. This issue was considered but not evaluated further because the proposed action does not include the construction of fuel breaks.
- Issue: Forest Service road 7633 was re-opened without public comment, and it does not appear it will be re-closed anytime soon. This action is inconsistent with the proposed action that states roads will be re-closed after use. Issues surrounding the opening and closing of Forest Service road 7633 in respect to other management projects undertaken by the refuge is outside the scope of this environmental assessment. The refuge has stated that any roads opened for the specific purpose of fire hazard reduction efforts associated with this EA will be closed following the completion of treatments.
- Issue: Wildlife conservation is the single mission for the Fish and Wildlife Service, and reducing the fire hazard for adjacent structures and residences is not consistent with that mission. Fire hazard reduction efforts by the Fish and Wildlife Service under the preferred alternative will promote desired wildlife habitats and species (See Appendix 1). In addition, the treatments would protect bald eagle nesting sites on and adjacent to the refuge, and protect existing and promote future eagle roosting sites on and off the refuge.
- Issue: The Refuge Complex should stop all haying and cattle grazing on public lands and forests. The issue of grazing and haying activities on Fish and Wildlife Service lands is outside the scope of this environmental assessment.

- Issue: Haying activities undermined previous volunteer efforts to plant willows, and haying trucks adversely impact recreation and the road system. The issue of haying and associated activities is outside the scope of this environmental assessment.
- Issue: A Comprehensive Conservation Plan, consistent with the National Wildlife Refuge Improvement Act, must be prepared before new or additional logging, grazing, or haying activities are undertaken. The Klamath Basin National Wildlife Refuge Complex is slated to develop its Comprehensive Conservation Plan in fiscal year 2007. Until such a time when the plan is completed, management activities within the 6 refuges of the complex may be undertaken, including habitat management, to fulfill refuge purposes.
- Issue: Pesticide spraying to benefit cattle is counter to Refuge wildlife purposes and needs to be addressed in the Refuge Comprehensive Conservation Plan. The development of the Comprehensive Conservation Plan and issues to be addressed in that effort are outside the scope of this environmental assessment.
- Issue: There are only a few residences and structures surrounding the Klamath Marsh Refuge, yet the Fish and Wildlife Service proposes to treat the entirety of the area; the scope of this action is too large and is a misapplication of refuge funds. In the Department of Interior and Related Agencies Appropriation Act, the U.S. Congress appropriated funds and directed federal agencies that manage public lands, including the U.S. Fish and Wildlife Service, to take measures to reduce the fire hazard in the wildland urban interface. There are approximately 11 residences and structures within and adjacent to the refuge (one-mile radius). The structures are primarily located in the east and southeast east borders of the refuge. The Fish and Wildlife Service classifies the wildland urban interface at the refuge as a "Rural Condition". In addition to funding involving the wildland/urban interface, other fuels reduction funding sources are also available.

1.4.4 Impact Topics Evaluated in this Environmental Assessment

Impact topics are derived from issues raised during internal and external scoping. Not every conceivable impact of a proposed action is substantive enough to warrant analysis. The following topics, however, do merit consideration in this environmental assessment:

Soils: Soils can potentially be adversely affected by fires as well as by thinning activities; therefore, impacts to soils are analyzed in this assessment.

Water Resources (including wetlands): Both fires and thinning activities can affect water resources by exposing soils or impacting riparian areas, which lead to erosion during storm events and subsequent suspended solids and turbidity in downstream surface waters. Therefore, impacts to water resources are analyzed in this assessment.

Vegetation: Fire hazard reduction efforts involve changes to the current vegetation structure and fire regime in the forest communities; therefore, this assessment considers the impacts on vegetation.

Wildlife: There are resident populations of various species of reptiles, amphibians, birds, mammals, and invertebrates on the refuge; therefore, impacts on wildlife are evaluated in this assessment.

Noise: Thinning and prescribed fire activities can all involve the use of noise-generating mechanical tools and devices with engines, such as chain saws and trucks. Since sensitive receptors (nesting bald eagles) are located near the refuge, noise impacts are evaluated in this assessment.

Air Quality: The Federal 1970 Clean Air Act stipulates that Federal agencies have an affirmative responsibility to protect air quality from adverse air pollution impacts. All types of fires generate smoke and particulate matter, which can impact air quality within the refuge and surrounding region to some extent; therefore impacts to air quality are evaluated in this assessment.

Recreation: Thinning and prescribed fire activities may impact recreation opportunities on the refuge; therefore, impacts to recreation are evaluated in this assessment.

Transportation: Thinning activities may include the use of large trucks to remove felled trees, and these operations could impact existing access roads in the refuge; therefore, this topic is evaluated in this assessment.

Socio-economics: NEPA requires an analysis of impacts to the “human environment” which includes economic, social and demographic elements in the affected area. Since commercial thinning may result with the implementation of the action alternatives, this impact topic is included for further analysis in this assessment.

Human Health and Safety: Fires can be extremely hazardous, even life-threatening, to humans, and current federal fire management policies emphasize that firefighter and public safety is the first priority. Since prescribed fire is a component of the proposed action, impacts to human health and safety are addressed in this assessment.

Cultural Resources: Section 106 of the National Historic Preservation Act of 1966 provides the framework for Federal review and protection of cultural resources, and ensures that they are considered during Federal project planning and execution. Cultural resources can be affected both by fire itself and thinning activities, and the Klamath Tribes have subsistence rights in the refuge, thus potential impacts to cultural resources are addressed in this assessment.

1.4.5 Impact Topics Considered but not Evaluated in this Environmental Assessment

NEPA and the CEQ Regulations direct agencies to “avoid useless bulk...and concentrate effort and attention on important issues” (40 CFR 1502.15). Certain impact topics that are sometimes addressed in NEPA documents on other kinds of proposed actions or projects have been judged to not be substantively affected by any of the alternatives considered in this assessment. These topics are listed and briefly described below, and the rationale provided for considering them, but dropping them from further analysis.

Land Use Plans/Policies/Controls: Selection of any of the alternatives would not set a precedent for future actions with significant effects on land use plans, policies or controls.

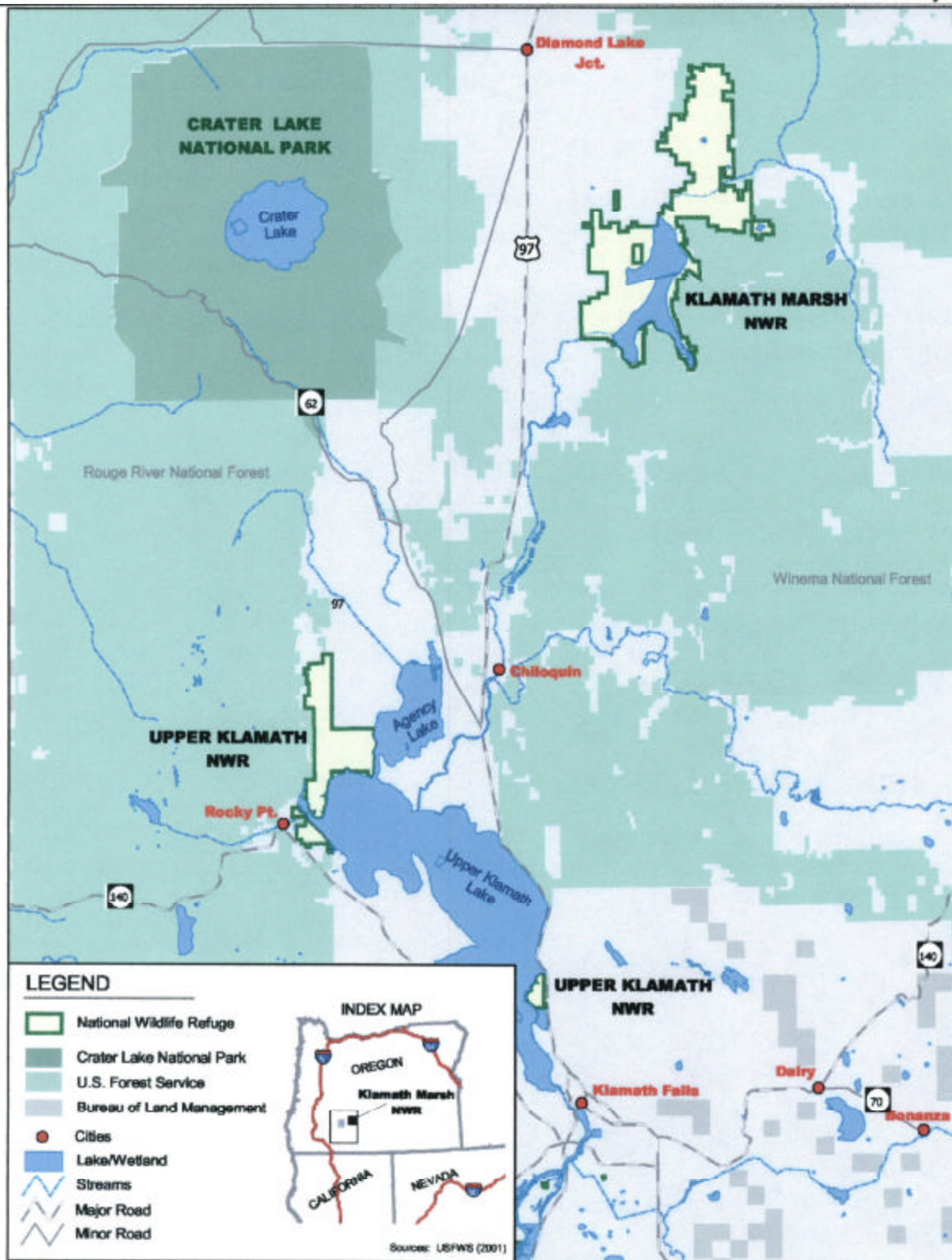


Figure 1-1 Klamath Marsh National Wildlife Refuge Vicinity

Chapter 2 - Issues and Alternatives

This Chapter describes the range of alternatives, including the Proposed Action and No Action Alternatives, formulated to address the purpose of and need for the proposed project. These alternatives were developed through evaluation of the comments provided by individuals, organizations, governmental agencies, and the Interdisciplinary Team.

2.1 ALTERNATIVES CONSIDERED BUT NOT ANALYZED FURTHER IN THIS EA

2.1.1 *Fire Hazard Reduction with Wildland Fire Use*

Wildland fire use involves the management of fires ignited by natural means (usually lightning) that are permitted to burn under specific environmental conditions for natural resource benefits. This alternative was considered but not analyzed further in this EA because the forested acreage of the refuge (3,400 acres) is too small to ensure fire containment within refuge boundaries. Refuge staff concluded that the potential risks to human health and safety and natural resources under this alternative outweigh any potential resource benefits that would be obtained from including wildland fire use.

2.1.2 *Fire Hazard Reduction with Prescribed Fire Only*

This alternative was considered but not analyzed further in this EA because the existing conditions over nearly the entire refuge, over-crowded forest stands and high levels of surface and ladder fuels, would make it impossible for Fish and Wildlife Service fire management personnel to ensure, with any degree of certainty, fire containment. Without employing thinning treatments in conjunction with prescribed fire, the probability of a prescribed fire burning out-of-prescription under the current fire hazard conditions is great enough that refuge staff concluded that the potential risks to human health and safety and natural resources under this alternative outweigh any potential resource benefits that would be obtained.

2.2 ALTERNATIVES CONSIDERED AND ANALYZED IN THIS EA

2.2.1 *Alternative 1 (No Action Alternative) – Suppression of All Wildfires and No Fire Hazard Reduction*

Under this alternative, the Fish and Wildlife Service would continue current management practices in the 3,400 forested acres of the Klamath Marsh Refuge. Management practices do not include any fire hazard reduction efforts (thinning, prescribed fire, wildland fire use). All wildfires would be actively suppressed.

2.2.2 Alternative 2 (Proposed Action) – Implement Thinning and Prescribed Fire Treatments to Reduce Fire Hazard while Enhancing Wildlife Habitats.

This alternative responds to the public's concerns regarding the impact of thinning and prescribed fire activities on wildlife habitat. Under this alternative, the Fish and Wildlife Service proposes to reduce fuels on up to 3,400 acres in the Klamath Marsh Refuge consistent with wildlife and habitat objectives for upland sites (see Appendix 1). The refuge would accomplish fire hazard reduction with manual and mechanical fuel treatments, as well as with prescribed fire (broadcast burning). The Service anticipates applying fuels treatments to no more than 2 units (see Figure 2-1) per year. Because of decades of timber removal by previous owners and fire suppression, fuels treatments and the re-introduction of fire are required to return the Refuge's forested and forest/meadow areas to the desired habitat conditions. **A more detailed description of desired future conditions, wildlife and habitat objectives, and prescriptions/restoration options for the forested habitats at Klamath Marsh NWR are described in Appendix 1.**

Manual (handsaws, chainsaws) and mechanical (large vehicles) fuel treatments would be employed on up to 3,400 acres (Figure 2-1). Stands of ponderosa pine would be thinned on average to 70-170 trees per acre, reflective of pre-European settlement ponderosa pine forest communities. Treated stands would also result in an average 40-60 basal area per acre, and an average tree spacing of 20 feet (distance between stems). Treated areas will retain some snags (dead trees) and large downed trees as these are important habitat for a variety of wildlife species. The Fish and Wildlife Service proposes to restore the ponderosa pine stands to an older, larger forest composition by thinning smaller and less healthy trees and favoring trees in the upper crown classes (thinning from below). No trees over 14" DBH would be thinned. In recognition of the forest health and wildlife benefits of forest stand clumps, as well as visual objectives, thinning would be done so as to provide a diverse, non-uniform appearance with a minimum of 15% of treated areas left as thickets. Thinned trees and ground fuels would be removed from the treatment units, chipped and scattered on site, or stacked in piles (slash piles) and burned. Ponderosa pine stands would be thinned by the refuge staff and/or through contracts with outside parties.

Thinning and prescribed fire operations within ½ mile of active eagle nests would be conducted outside of the nesting season (January 1 – August 15). Additionally, prior to fuels treatments and prescribed fire associated with this Alternative, the Refuge would consult under Section 7 of the Endangered Species Act to ensure that all activities minimize potential effects to listed species. In order to avoid potential impacts to calving and fawning mule deer and elk, fuel treatments would not be conducted in these areas between May 15 and July 15. The FWS will identify the areas to be avoided during this time frame by consulting with the Oregon Department of Fish and Wildlife and the Klamath Tribes. Within 100 feet of surface water resources, mechanical equipment would be prohibited and manual thinning and prescribed fire would be limited to the removal of encroaching lodgepole pine in wet and dry meadows and aspen stands.

Prescribed fire would be employed in treated areas to remove ground fuels and slash from thinning operations, and later, to restore the low-severity, high frequency fire regime of the ponderosa pine forest communities. Piles of slash and collected surface fuels from thinning operations would be burned during winter months. To eliminate or minimize potential impacts

to cultural sites, the Refuge will include Service and Klamath Tribal archeologists in all fuels treatment and prescribed fire planning and implementation activities. Consultations will include discussions on site-specific fire hazard reduction activities in the various treatment units.

2.2.3 Alternative 3 – Implement Thinning and Prescribed Fire Treatments to Reduce Fire Hazard without Considerations for Wildlife Habitat

Under this alternative, fire hazard reduction would occur on 3,400 acres of forested lands on the Klamath Marsh National Wildlife Refuge. The Fish and Wildlife Service would implement thinning and prescribed fire treatments similar to those described under the Proposed Action, with a few exceptions. In order to maximize the degree of fire hazard reduction, 1) manual and mechanical thinning treatments would occur within 50 feet of surface water resources and would not be restricted to the removal of encroaching lodgepole pines in dry and wet meadows, 2) thinning in lodgepole pine forests would be more intensive (70-170 trees per acre), and 3) the thinning specification to leave a minimum of 15% of treated areas in thickets would be lifted.

2.2.4 Alternative 4 – Fire Hazard Reduction by Manual and Mechanical Thinning (No Prescribed Fire) with Considerations for Wildlife Habitat

This alternative responds to the public's concerns regarding wildlife habitat, and the possible escape of prescribed fire and any associated human health & safety issues associated with such an event. Under this alternative, fire hazard reduction activities and prescriptions would be similar to those described under the Proposed Action, however, prescribed fire would not be employed.

2.3 IMPACT DEFINITIONS

Table 2-1 depicts the impact definitions used in this Environmental Assessment. Significant impact thresholds for the various impact topics were determined in light of compliance with existing state and federal laws, and compliance with existing Klamath Marsh National Wildlife Refuge planning documents.

Table 2-1 Impact Definitions

Impact Topics	"Minor" Impact	"Significant" Impact
Soils	Minor damage to or loss of the litter/humus layers that causes minor localized increases in soil loss from erosion; fire severe enough to cause minor harm to soil community; minor, temporary surface sterilization of soils that does not cause long term loss of soil productivity that would alter or destroy vegetation community; short-term and localized compaction of soils that does not prohibit re-vegetation	Damage to or loss of the litter/humus layers that would increase soil loss from erosion on a substantial portion of the burn area; fire severe enough to damage soil community; substantial surface sterilization of soils that may cause long term loss of soil productivity and that may alter or destroy a portion of the vegetation community; long-term and widespread soil compaction that affects a large number of acres and prohibits re-vegetation
Water Resources (including wetlands)	Minor damage to or loss of the litter/humus layers that increases sedimentation on no more than 0.1% of a subwatershed; localized and indirect riparian impact that does not substantively increase stream temperatures or affect stream habitats; no alteration of natural hydrology of the wetlands	Damage to or loss of the litter/humus layers that increases sedimentation on greater than 0.1% of a subwatershed; localized and indirect riparian impact that may substantively increase stream temperatures or affect stream habitats; alteration of natural hydrology of the wetlands
Vegetation	Short-term changes in plant species composition and/or structure, consistent with expected successional pathways of a given plant community from a natural disturbance event; thinning of small diameter understory trees	Violation of the Endangered Species Act of 1973; removal of large diameter or old growth trees greater than 80cm at breast height;
Wildlife	Temporary displacement of localized individuals or groups of animals; isolated mortality of individuals of species not afforded special protection by state and/or federal law	Violation of the Endangered Species Act of 1973; mortality of species that jeopardize the resident population
Air Quality	Minimal to negligible air emissions and temporary smoke accumulation; temporary and limited smoke exposure to sensitive resources	Violation of state and federal air quality standards; prolonged smoke exposure to sensitive receptors
Noise	<65 dBA at sensitive receptors; temporary noise levels <90 dBA	>65 dBA noise level at sensitive receptors (schools, nursing homes, etc.); continued exposure to noise

	“Minor” Impact	“Significant” Impact
		levels > 90 dBA for workers and/or the general public
Recreation	Temporary displacement of recreationists or closure of trails, and recreation areas during off-peak recreation use; temporary or short-term alteration of the vista, or temporary presence of equipment/structures in localized area; smoke accumulation during off-peak recreation use	Permanent closure of trails and recreation areas; conflict with peak recreation use; long-term change in scenic integrity of the vista; substantive smoke accumulation during peak recreation use
Transportation	An increase in traffic that is not predicted to upset the normal flow of traffic; the need for minor road repair as a result of the action; the generation of traffic levels that does not require the expansion of existing roadways or facilities	An increase in traffic that is predicted to upset the normal flow of traffic; the need for major road repair as a result of the action; the generation of traffic levels requiring the expansion of existing roadways or facilities
Socioeconomics	Minimal to no short or long-term economic impact on local or regional economy (>2%); proportionate impact on poor or minority communities	A change in local or regional economy greater than 2%; disproportionately high and adverse impact on poor or minority communities
Human Health & Safety	Minor injuries to any worker; limited exposure to hazardous compounds or smoke particulates at concentrations below health-based levels	Serious injury to any worker or member of the public; exposure to hazardous compounds or smoke particulates at concentrations above health-based levels.
Cultural Resources	Temporary, non-adverse effects to registered heritage sites, eligible heritage sites, sites with an undetermined eligibility, and traditional cultural properties	Temporary or long-term adverse impacts to registered heritage sites, eligible heritage sites, sites with an undetermined eligibility, and traditional cultural properties

2.4 MITIGATION MEASURES AND MONITORING

Klamath Basin National Wildlife Refuge Complex staff would collect information on fuel reduction efforts, vegetative resources, and other objective dependant variables after a fire (wildfire or prescribed fire). During fire events (prescribed fire), data would be collected regarding the current fire conditions consistent with the variables identified in a prescribed burn plan, such as fuel and vegetation type, anticipated fire behavior and fire spread, current and forecasted weather, smoke volume and dispersal, etc.

Mitigation measures are prescribed to prevent and/or mitigate adverse environmental impacts that may occur from fire hazard reduction activities. Mitigation measures are common to all alternatives.

2.4.1 *Fire Management Activities*

- No handlines exposing mineral soil will be allowed through cultural sites, and all handlines will be rehabilitated. Erosion control methods will be used on slopes exceeding 30% where handline construction takes place;
- All sites where improvements are made removed will be rehabilitated to pre-fire conditions, to the extent practicable;
- Whenever consistent with safe, effective suppression techniques, the use of natural barriers will be used as extensively as possible;

2.4.2 *Soil and Water Resources*

- Stream crossings will be limited to set and existing locations;
- Except for spot maintenance to remove obstructions, no improvements will be made to intermittent/perennial waterways, trails, or clearings in forested areas;
- Fire lines will be located outside of highly erosive areas, steep slopes, intermittent streams, and riparian and other sensitive areas;
- Fire retardants and foams will not be used in riparian areas;
- Mechanical thinning (large equipment) will be prohibited on steep slopes (>30% slope);
- Mechanical equipment will be restricted in operations to dry, frozen, or snow-covered ground (<20% soil moisture);
- Slash generated from mechanical thinning activities would be spread on the pathways of the equipment to minimize soil compaction;

2.4.3 *Wildlife*

- During the bald eagle nesting season (January 1 -August 15), prescribed fire and fuels reduction activities will not be allowed in stands that are located within ½ mile of active eagle nests. The Refuge will consult under Section 7 of the Endangered Species Act to ensure no or minimal impacts to listed species prior to implementing the preferred Alternative.
- To protect mule deer and elk calving and fawning grounds, thinning and prescribed fire activities will be prohibited in these areas between May 15 and July 15. The Fish and Wildlife Service will identify the areas to be avoided during this time frame by consulting with the Oregon Department of Fish and Wildlife and the Klamath Tribes.

2.4.4 *Transportation*

- Road improvements will be made as necessary to repair damage to the access roads resulting from vehicle use associated with thinning operations.

2.4.5 Cultural Resources

- Prior to all thinning and prescribed fire activities, archeologists from the Klamath Tribes and the Service will be consulted. This will ensure that cultural resources sites are avoided.
- If unrecorded cultural resources are discovered during thinning and prescribed fire activities, all work in the immediate vicinity of the cultural resource will stop until a Service and Klamath Tribal Archeologist surveys and records the location.

2.5 COMPARISON OF ALTERNATIVES

Table 2-2 briefly summarizes the environmental effects of the various alternatives. It provides a quick comparison of how well the alternatives respond to the project need, objectives and impact topics. Chapter 3 discusses the environmental consequences of the proposed alternatives in detail.

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Fire Reduction w/ Enhanced Wildlife Habitat)	Alternative 3 – Fire Reduction w/o Considerations for Wildlife Habitat	Alternative 4 - Thinning Treatments Only w/ Considerations for Wildlife Habitat
Project Need				
Fire hazard reduction	No, hazardous fuels would continue to increase This alternative provides the least hazardous fuels reduction	Yes, hazardous fuels reduction over time on up to ~3,400 acres This alternative provides less hazardous fuels reduction than Alternative 3, but more than Alternative 4	Yes, hazardous fuels reduction over time on ~3,400 acres This alternative provides the greatest hazardous fuels reduction	Yes, hazardous fuels reduction over time on ~3,400 acres This alternative provides less hazardous fuels reduction than do Alternatives 2 & 3
Enhance forested and forest/meadow edge habitats on the Refuge.	No, wildlife habitat enhancement occurs on forested or forest/meadow edge sites on Refuge.	Yes, hazardous fuel treatments would help restore and maintain health to wildlife habitats on the Refuges. This alternative provides the greatest amount of wildlife habitat enhancement toward desired future conditions (see Appendix 1).	Yes, hazardous fuel treatments would help restore and maintain health to wildlife habitats on Refuge. This alternative provides less wildlife habitat benefits than does Alternative 2, but more than Alternative 4	Yes, hazardous fuel treatments would help restore and maintain health to wildlife habitats on Refuge. This alternative provides less wildlife habitat benefits than do Alternatives 2 & 3
Project Objectives				
Protect neighboring residences from future wildfires	Besides wildland fire suppression, no additional protection to neighboring residences would be provided This alternative provides the least degree of protection to neighboring residences from future wildfires	Yes, hazardous fuel treatments would help protect neighboring residences from future wildfires This alternative provides less protection to neighboring residences from future wildfire than does Alternative 3, but	Yes, hazardous fuel treatments would help protect neighboring residences from future wildfires This alternative provides the greatest degree of protection to neighboring residences from future	Yes, hazardous fuel treatments would help protect neighboring residences from future wildfires This alternative provides less protection to neighboring residences from future wildfire than do

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Fire Reduction w/ Enhanced Wildlife Habitat)	Alternative 3 – Fire Reduction w/o Considerations for Wildlife Habitat	Alternative 4 - Thinning Treatments Only w/ Considerations for Wildlife Habitat
Significant Issues		more than Alternative 4	wildfires	Alternatives 2 & 3
Protection of cultural resources	Cultural resources would be avoided during wildfire suppression activities	Cultural resources would be identified and avoided during hazardous fuel treatments	Cultural resources would be identified and avoided during hazardous fuel treatments	Cultural resources would be identified and avoided during hazardous fuel treatments
Prescribed fire escape	There would be no potential for escape of prescribed fire since there would be no prescribed fires	This alternative allows for prescribed fire, however, potential for escape would be minimal in light of mitigation measures and adherence to guidelines and procedures for ignition of prescribed fires	This alternative allows for prescribed fire, however, potential for escape would be minimal in light of mitigation measures and adherence to guidelines and procedures for ignition of prescribed fires	There would be no potential for escape of prescribed fire since there would be no prescribed fires
Impact Topics				
Soils	No immediate soil impacts; potential for soil erosion in the event of a large, high- severity wildfire	Minor short-term soil erosion and compaction impacts resulting from thinning and prescribed fire activities; soil buildup and enrichment from prescribed fires	Minor short-term soil erosion and compaction impacts resulting from thinning and prescribed fire activities; soil buildup and enrichment from prescribed fires	Minor short-term soil erosion and compaction impacts resulting from thinning
Water Resources (including wetlands)	No immediate water resource impacts; potential for high levels of sediment delivery from erosion in the aftermath of a large, high-severity wildfire	Minor indirect impacts to water resources from thinning, prescribed fires, and construction of fire lines	Minor indirect impacts to water resources from thinning, prescribed fires, and construction of fire lines	Minor indirect impacts to water resources from thinning

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Fire Reduction w/ Enhanced Wildlife Habitat)	Alternative 3 – Fire Reduction w/o Considerations for Wildlife Habitat	Alternative 4 - Thinning Treatments Only w/ Considerations for Wildlife Habitat
Vegetation	No reduction of hazardous fuels on up to 3,400 acres of the refuge; no restoration of wildlife habitats; fire-intolerant, shade-tolerant plant species continue to out-compete fire-tolerant, shade-intolerant plant species; increased risk of bark beetle infestations and large, high-severity wildfires destroying forest stands in the refuge; habitat and plant diversity continue to decline	Reduction of hazardous fuels on up to 3,400 acres of the refuge; enhancement of desired habitat conditions occur, more open canopies, and restoration of natural fire regimes; plant habitat and diversity increase over time; promotion of fire-tolerant, shade-intolerant plant species, as well as the development of large diameter trees (old-growth); potential for bark beetle infestations reduced with greater tree vigor; forest stands better able to withstand high-severity wildfires	Reduction of hazardous fuels on up to 3,400 acres of the refuge; some wildlife habitat improvements with reduction in tree densities, more open canopies, and restoration of natural fire regimes; plant habitat and diversity increase only marginally as a result of the loss of clumps and thickets; promotion of fire-tolerant, shade-intolerant plant species, as well as the development of large diameter trees (old-growth); potential for bark beetle infestations reduced with greater tree vigor; forest stands better able to withstand high-severity wildfires	Similar to Alternative 2, however wildlife habitat and diversity marginally improved with thinning as a fire surrogate; ponderosa pine impacted in the absence of prescribed fire and natural fire regime (high frequency, low-severity fires)
Wildlife	No immediate wildlife impacts; continued high potential for a large, high-severity wildfire destroying bald eagle nesting and roosting sites in the refuge.	Hazardous fuels reduction would temporarily displace some wildlife species and result in isolated mortality of individuals; very minor to no impact on bald eagles; big game species temporarily displaced during fuels	Similar to Alternative 2, however minor impact (shift in distribution) to big game populations on the refuge with the loss of "high-quality" fawning and calving grounds; loss of hiding cover for big game and	Similar to Alternative 2, however, wildlife habitat and diversity continue to decrease in the absence of prescribed fire.

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Fire Reduction w/ Enhanced Wildlife Habitat)	Alternative 3 – Fire Reduction w/o Considerations for Wildlife Habitat	Alternative 4 - Thinning Treatments Only w/ Considerations for Wildlife Habitat
		treatments; wildlife habitat and diversity reach desired conditions.	other wildlife species	
Air Quality	No immediate air quality impacts; air quality impacts from future wildfires would be greater in the absence of hazardous fuels reduction	Minor and short-term air quality impacts from prescribed fires	Minor and short-term air quality impacts from prescribed fires	No immediate air quality impacts
Noise	No noise impacts	Minor noise impacts during thinning activities and transportation of felled trees off-site; minor to no impact on nesting bald eagles and other bird species.	Minor noise impacts during thinning activities and transportation of felled trees off-site; minor to no impact on nesting bald eagles and other forest birds.	Minor noise impacts during thinning activities and transportation of felled trees off-site; minor to no impact on nesting bald eagles and other forest birds.
Recreation	No recreation impacts; short- term impacts may occur in the event of a large, high- severity wildfire	Minor impacts during thinning and prescribed fire activities (trail and road closures, displacement tribal members exercising subsistence rights)	Minor impacts during thinning and prescribed fire activities (trail and road closures, displacement of tribal members exercising subsistence rights)	Minor impacts during thinning and prescribed fire activities (trail and road closures, displacement of tribal members exercising subsistence rights)
Transportation	No transportation-related impacts	Minor impact to local traffic and existing access roads to the refuge with the use of large trucks to haul out felled trees	Minor impact to local traffic and existing access roads to the refuge with the use of large trucks to haul out felled trees	Minor impact to local traffic and existing access roads to the refuge with the use of large trucks to haul out felled trees

Table 2-2 Comparison of Alternatives' Responses to Project Need, Objectives, Significant Issues, and Impact Topics

	Alternative 1 - No Action Alternative (Current Management Actions)	Alternative 2 - Proposed Action (Fire Reduction w/ Enhanced Wildlife Habitat)	Alternative 3 – Fire Reduction w/o Considerations for Wildlife Habitat	Alternative 4 - Thinning Treatments Only w/ Considerations for Wildlife Habitat
Socio-economics	No impacts to minority or low-income populations; no impact on local and regional economies; no increase in revenue sharing with the County	No impacts to minority or low-income populations; very minor impact on local and regional economies; very minor to no increase in revenue sharing with the County	No impacts to minority or low-income populations; very minor impact on local and regional economies; very minor to no increase in revenue sharing with the County	No impacts to minority or low-income populations; very minor impact on local and regional economies; very minor to no increase in revenue sharing with the County
Human Health & Safety	Short and long-term safety risk to adjacent residences from high fire hazard on the refuge; continued high-potential for a large, high-severity wildfire; risks to firefighter safety remain high	Human health and safety improved with reduction in hazard following thinning and prescribed fire treatments; increased potential for isolated injuries to crews from thinning activities; minor exposure to smoke by workers and the public during prescribed fires	Human health and safety improved with reduction in fire hazard following thinning and prescribed fire treatments; increased potential for isolated injuries to crews from thinning activities; minor exposure to smoke by workers and the public during prescribed fires	Similar to Alternative 2 except that workers and the public would not be exposed to smoke from prescribed fires; human health and safety improved with reduction in fire hazard following thinning efforts, however, the improvement would be less than that obtained under Alternatives 2 & 3
Cultural Resources	No immediate impacts to cultural resources; potential long-term risk to cultural resources from increased fire hazard and large, high-severity wildfires	No impacts to known cultural resources	No impacts to known cultural resources	No impacts to known cultural resources

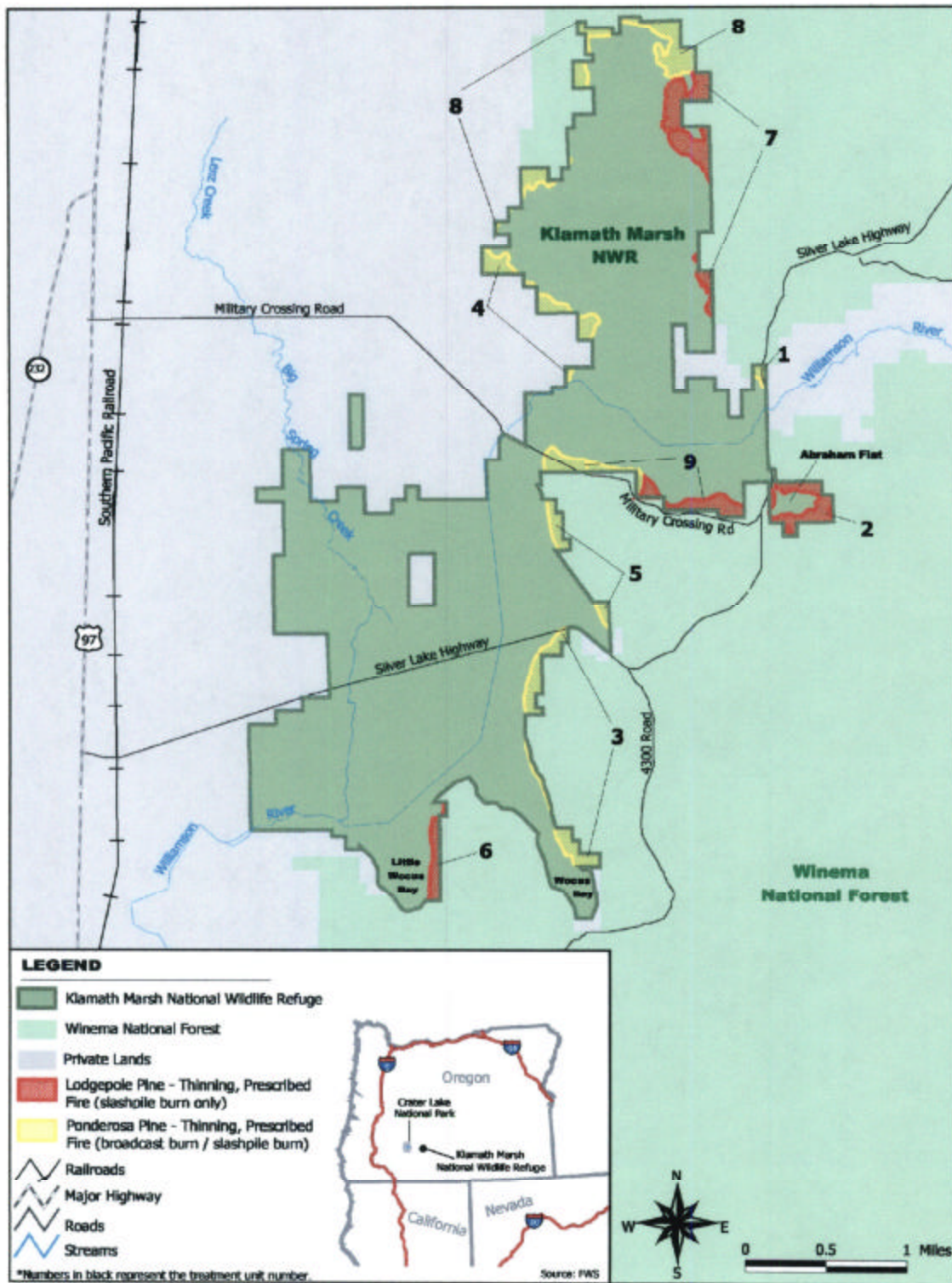


Figure 2-1 Fire Hazard Reduction Treatments. Lodgepole stands also include areas of ponderosa pine and aspen. Ponderosa stands include some areas of lodgepole and aspen.

Chapter 3 – Environmental Analysis

This chapter summarizes the existing environmental conditions and the probable environmental consequences (effects) of implementing the proposed action and No-Action alternatives. This chapter also provides the scientific and analytical basis for comparing the alternatives. The probable environmental effects are quantified where possible; where not possible, qualitative descriptions are provided.

3.1 SOILS

3.1.1 *Affected Environment*

There are six major soil series within the Klamath Marsh National Wildlife Refuge boundary: Yamsay, Mazama, Chinchallo, Kirk, Lapine, and Shanahan. Yamsay and Mazama soils are the predominant soils in the Refuge and are found in the seasonal/permanent marshes. Chinchallo and Kirk soils are found in meadows in northeast, east, and southwest portions of the Refuge, while Lapine and Shanahan soils are found in the forested areas in the northwest.

Yamsay soils are characterized by diatomaceous muck and sedimentary peat and are very poorly drained and ponded. The principal vegetation that grows on Yamsay soils is bulrush (*Scirpus sp*) and sedge (*Carex sp*), which is believed to be the source responsible for the accumulation of the muck and peat on the Klamath Marsh. Mazama soils contain peat and muck, as well as higher proportions of diatomaceous sediments than that contained in Yamsay soils. Mazama soils frequently become drained well enough in the late summer and fall months to afford limited grazing. Native vegetation on Mazama soils includes reeds, sedges, and rushes.

Chinchallo soils consist of diatomaceous sediments deposited over pumice, and are imperfectly to poorly drained. Native vegetation occurring on Chinchallo soils includes meadow grasses, sedges, reeds, and rushes. Kirk soils are derived primarily from pumice, ferromagnesium minerals, and diatomaceous sediments, which lay above coarse gravelly sands. Kirk soils are imperfectly to poorly drained. Native vegetation consists largely of annual and perennial grasses, sedges, rushes and reeds.

Lapine soils are characterized as excessively drained gravel and sand over pumice cinders and ash. Native vegetation consists primarily of ponderosa pine with an understory of grasses and shrubs. Shanahan soils are also well drained and support native vegetation similar to Lapine soils. The Refuge also contains Skellock soils, which are Regosols developing under lodgepole pine (USFWS, 1987; USFWS, 1989).

3.1.2 *Environmental Consequences*

Soil impacts were qualitatively assessed using soil characteristics, literature reviews, and mitigation measures.

3.1.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any actions that would directly impact soils. In the absence of fire hazard reduction treatments, however, the likelihood of a high-severity fire increases. Such an event could be detrimental to soils as nutrients are volatilized and the organic layer of the soil could be consumed and soil layers could become water repellent. In addition, the potential for erosion would increase following a high-severity fire.

3.1.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact soils include building fire lines, thinning, and prescribed fire (slashpile and broadcast burning). Soil series most likely to be affected by these activities would be Chinchallo, Kirk, Lapine, and Shanahan.

The construction of a fire line involves digging a 3-4 foot wide line down to mineral soil. Fire line construction would result in soil disturbance and could lead to increased erosion, especially in steeply sloped areas. The refuge, however, contains only a few areas where slopes reach 20%. To avoid potential impacts, fire lines would be located outside of highly erosive areas, steep slopes, and other sensitive areas. Following prescribed fire or suppression activities, fire lines would be rehabilitated.

Thinning activities that involve heavy machinery would result in compaction of soils in localized areas of ingress and egress. The degree of soil compaction depends on the number of passes over a particular area as well as the type of vehicle. Slash generated from mechanical thinning activities would be spread on the pathways of the equipment to minimize soil compaction. In addition, mechanical equipment (large vehicles) would not be employed in highly sloped portions of the treatment areas (> 30% slope) and would be restricted in operations to dry, frozen, and snow-covered ground (<20% soil moisture). As a component of the proposed action, large vehicles would be prohibited within 100 feet of surface water resources.

Prescribed fire would release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrition for vegetation in the area. In addition to increasing nitrification of the soils and increasing minerals and salt amounts in the soil, the ash and charcoal residue resulting from incomplete combustion would aid in soil buildup and soil enrichment by being added as organic matter to the soil profile. The added material works in combination with dead and dying root systems to make the soil more porous, better able to retain water, and less compact while increasing needed sites and surface areas for essential microorganisms, mycorrhiza, and roots (Vogl, 1979; Wright and Bailey, 1980).

If a prescribed fire exceeded a burn prescription and burned “hot”, resulting in areas of high-burn severity, the organic layer of the soil could be consumed and soil layers could become water repellent. Fire management personnel would contain and/or suppress out-of-prescription fires, minimizing the potential for and effects of any high-burn severity prescribed fires.

3.1.2.3 Alternative 3

General soil impacts would be similar to those described under Alternative 2, however, the use of mechanical equipment (large vehicles) near riparian areas would potentially aggravate soil erosion and stream bank destabilization. In light of the prohibition of large vehicles within 50 feet of surface water resources, these impacts would be minor.

3.1.2.4 Alternative 4

General soil impacts would be similar to those described under Alternative 2, except the benefits accruing to soils from prescribed fire would not occur.

3.2 WATER RESOURCES (INCLUDING WETLANDS)

3.2.1 *Affected Environment*

The Williamson River and Big Spring Creek are the primary sources of surface water for the refuge. Several small creeks and springs also supplement water flows into the marsh. Groundwater flows on the refuge and surrounding area are heavy, resulting in open water potholes, artesian, and small springs. The refuge contains approximately 37,700 acres of seasonal and permanent marsh.

3.2.2 *Environmental Consequences*

Water resource impacts were qualitatively assessed using presence/absence and mitigation measures.

3.2.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any actions that would directly impact water resources. In the absence of fire hazard reduction treatments, however, the likelihood of a high-severity fire increases. Such an event could be detrimental to water resources as increased erosion could result in increased, short-term sedimentation and turbidity.

3.2.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact water resources include building fire lines, thinning, and prescribed burning; however, in light of the mitigation measures employed during fire management activities (e.g. no fire line construction in streams, wetlands or adjacent to natural springs, no heavy equipment within 100-feet of surface water resources) and the location of treatment units, there would be very minor indirect impacts on surface water resources on the refuge (sediment delivery and turbidity).

Evapotranspiration by vegetation withdraws available near surface moisture from the aquifer during the growing season. After several years, the cumulative effects of evapotranspiration can reduce surface water contributions to the aquifer during the spring runoff and runoff after the spring peak flow (Williamson River Basin Watershed Analysis, 1999). Reducing timber densities in the refuge would indirectly benefit ground water and the marsh by decreasing the extent of evapotranspiration and indirectly increasing surface water contributions to the aquifer.

3.2.2.3 Alternative 3

General water resources impacts under Alternative 3 would be similar to those described under Alternative 2, however, manual and mechanical thinning near riparian areas could lead to bank destabilization and could reduce shading of the water resource. These effects could lead to an increase in sediment delivery, turbidity, and localized water temperatures. In light of the prohibition of large vehicles within 50 feet of water resources, these impacts would be minor.

3.2.2.4 Alternative 4

General water resources impacts under Alternative 4 would be similar to those described under Alternative 2.

3.3 VEGETATION

3.3.1 *Affected Environment*

Ponderosa pine and lodgepole pine are the dominant trees in the refuge, with a few scattered patches of quaking aspen (*Populus tremuloides*). The refuge also contains wet and dry meadows and large acreages of seasonal and permanent marsh.

Wildland fire suppression in the refuge and adjacent areas has altered the historic composition of forested habitats. Areas that were open park-like stands of large trees with clumps of small trees have transitioned into dense, overstocked young stands with several canopy layers (USFS, 2000a). Native grasses and forbs, which dominated the understory in historic ponderosa pine communities, have been largely replaced with shrub species such as bitterbrush (*Purshia tridentata*) and manzanita (*Arctostaphylos patula*). In the absence of wildland fires, lodgepole pine has encroached into the dry and wet meadows of the refuge, such as Abraham Flat. Generally, fire exclusion in the refuge has selected for the growth and development of shade-tolerant plant species at the expense of shade-intolerant ones.

Overly dense forest stands not only pose a high fire hazard, they can lead to outbreaks of a group of insects called bark beetles (Family *Scolytidae*). These are among the most destructive insects of North American conifer forests. Many species reach epidemic proportions in forests that are either overmature, overstocked or stressed by drought or wildfire. Bark beetles attack the cambium layer of trees where they construct egg and larval galleries. Trees that are successfully attacked are killed. In addition, most bark beetles introduce blue stain fungi into infested trees. These fungi enter the woody tissue and hasten the death of infested trees. Some bark beetles are

capable of attacking trees weakened by fire and the brood emerging from the fire-damaged trees can attack and kill trees suffering slight fire damage or no damage (USFS, 2000b). The refuge also contains mistletoes, which are generally host specific and can inhibit and/or kill their tree hosts. Their occurrence and intensity are independent of site quality or tree stocking levels.

Once fire hazard reduction treatments improve overall forest health, however, some natural mortality would be acceptable in the refuge from insect and disease attacks. Disease and insects are primary sources of discontinuities in forest stand structure and are important natural sources of landscape diversity (Lundquist, 1993).

Klamath Marsh contains several populations of noxious weeds, however, infestation is considered small to moderate. Canada thistle (*Cirsium arvense*) occurs in small numbers on the refuge, but presents a greater management concern to the Forest Service on lands adjacent to the refuge. St. Johnswort (*Hypericum perforatum*) is more abundant on the refuge, but remains only a moderate problem (Johnson, 2002).

There are no known federally-protected plant species found within the refuge.

3.3.2 *Environmental Consequences*

Vegetation impacts were qualitatively assessed using literature reviews and quantitatively assessed by acres impacted.

3.3.2.1 Alternative 1 – No Action

Under the No Action Alternative, hazardous fuel loadings would continue to accumulate in the refuge. Existing high densities of trees would continue to stress the forest stands and make them more susceptible to bark beetle infestations. Habitat diversity and plant species diversity in the refuge would decline in the absence of thinning or prescribed fire treatments. Grasses and forbs would continue to be replaced with shrub species. Finally, forest communities with their associated plant species would continue to transition from fire-tolerant, shade-intolerant species to fire-intolerant, shade-tolerant ones. There would be an increased probability that a wildfire under these conditions would become a crown fire and/or stand replacement. Overall, forested habitat conditions on the refuge would remain at less than desirable conditions.

3.3.2.2 Alternative 2 – Proposed Action

Thinning and prescribed fire activities would occur on up to 3,400 acres of the refuge under this alternative.

The restoration of the historic fire regime to ~2,000 acres of ponderosa pine would enhance the variety and diversity of native plant species and habitats. Ponderosa pine plant communities adapted to high frequency, low-severity fires would be favored with the use of prescribed fire. Native grasses and forbs would increase in the understory, and high-frequency prescribed fires would reduce the number of native shrub species like sagebrush (*artemisia*), bitterbrush, and

manzanita in the short term. Since a majority of the shrub component is of the same age class as a result of the absence of wildfire in the refuge, the use of prescribed fires would help return a diversity of age classes to the shrub component in the refuge. Prescribed fire would release nutrients into the soil and the fertilization effects of ash would provide an important source of nutrition for vegetation in the area (Vogl, 1979; Wright and Bailey, 1980). Finally, prescribed fire would kill some trees and ensure a renewable supply of snags in the forest.

Thinning activities in ponderosa pine and lodgepole pine would focus on small understory trees, which would reduce tree densities and help return ponderosa pine stands to an open park-like structure characteristic of pre-European settlement conditions. At least 15% of the treatment areas would be maintained as clumps, or thickets, of trees; however, some minor thinning may be employed within those existing clumps. Some woody debris would be left on site to provide for wildlife habitat, particularly small rodents that provide a food base for owls, raptors, and other wildlife.

Thinning and prescribed fire activities would remove some dead, damaged, and stressed trees, which are weakened and susceptible to insect infestations, and would decrease the likelihood of spreading bark beetle infestations. Thinning activities in ponderosa pine would also decrease the likelihood of large, high-intensity fires in the future that could result in large areas of stand mortality, which in turn, could lead to an increased likelihood of bark beetle infestation.

The removal of lodgepole pine from dry and wet meadows would help increase the habitat and plant diversity in these areas and for the refuge as a whole. In addition, removal of lodgepole pine from aspen stands would spur aspen regeneration as would prescribed fire.

Suppression activities that resulted in soil disturbance (fire lines) would make those disturbed areas more susceptible to noxious weed infestation. Disturbed areas would be monitored for noxious weed infestation and, in the event of noxious weed colonization, would be treated with appropriate management techniques. Thinning and fire activities would retard the encroachment of woody tree species into meadows and would reduce hazardous fuels buildup.

Generally, ponderosa pine stands in the refuge would contain lower amounts of surface and ladder fuels, as well as larger crown spacing. These characteristics provide for more healthy forest stands, enable them to better withstand mixed- or high-severity wildland fires, and help prevent surface fires from becoming pervasive and destructive crown fires.

3.3.2.3 Alternative 3

General vegetation impacts under Alternative 3 would be similar to those described under Alternative 2, however, more extensive thinning in lodgepole pine forests would further reduce tree densities than those obtained under Alternative 2. Thinning activities within 50-100 feet of surface water resources would increase the total number of trees removed. The lack of management for clumps of trees would reduce habitat diversity in the forest stands.

3.3.2.4 Alternative 4

General vegetation impacts under Alternative 4 would be similar to those described under Alternative 2; however, the exclusion of prescribed fire would not result in the restoration of the natural fire regimes to refuge forests or forest meadow edges. In its absence, conditions would continue to favor shrub species over native grasses and forbs, and fire-intolerant plant species over fire-tolerant ones. Forest health would be improved with a reduction in tree densities, however, thinning treatments alone as a fire surrogate would not fully restore forest communities on the refuge. Habitat and species diversity would continue to decline in the absence of prescribed fire.

3.4 WILDLIFE

3.4.1 *Affected Environment*

A variety of wildlife resources inhabit the forests, meadows, and wetlands of Klamath Marsh National Wildlife Refuge including ungulates, small mammals, birds, fish, reptiles, amphibians, and invertebrates. Some common species include coyote (*Canus latrans*), mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus*), sandhill crane (*Grus canadensis*), mallard (*Anas platyrhynchos*), redhead (*Aythya americana*), cinnamon teal (*Anas cyanoptera*), lesser scaup (*Aythya affinis*), tundra swan (*Cygnus columbianus*), and Canada goose (*Branta canadensis*).

The refuge supports thousands of migrating and breeding waterfowl, as well as a host of other wildlife species. Approximately 45-60 pairs of sandhill cranes breed on the refuge. As water levels recede during late summer and early fall, excellent crane feeding conditions are created in the marsh. Close to 16,000 tundra swans have been observed on the refuge during spring migration. The refuge is also an important area for neotropical migratory birds that are dependent on both wetland and upland habitats.

The refuge contains calving and fawning areas for mule deer and Rocky Mountain elk, primarily in the northern portions of the refuge (treatment units 4,7, and 8). Thickets of ponderosa pine and lodgepole pine with understory shrubs provide hiding cover and forage for these big game species. While fawning and calving areas can be found in adjacent private and public lands (Winema National Forest), those contained in the refuge are considered "high-quality" because of the close proximity to riparian areas, the associated forest edge habitat, and the abundance of forage (Collom, 2002).

The federally-threatened bald eagle is a regular visitor with several active nesting and roosting sites on the refuge (treatment units # 4 and #7) and in the Winema National Forest immediately adjacent to the refuge boundaries. Klamath Marsh also supports populations of yellow rails (*Coturnicops noveboracensis*) and the Oregon spotted frog (*Rana pretiosa*), a candidate (Category 1 species) for listing under the Endangered Species Act.

3.4.2 *Environmental Consequences*

Wildlife impacts were qualitatively assessed using presence/absence determinations, literature reviews, and mitigation measures

3.4.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct or short-term indirect impacts to wildlife. In the long-term, wildlife habitat and populations would likely be subjected to increased potential of high-severity fires that would destroy habitat, including calving and fawning areas on the refuge. In addition, the canopy in the forest communities would continue to close and inhibit the growth of understory vegetation, such as grasses, forbs, and shrubs. Wildlife habitat and diversity would continue to decline in the absence of fire hazard reduction efforts. Achieving desired habitat conditions (Appendix 1) for wildlife would not occur.

3.4.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact wildlife include building fire lines, fire retardant use associated with any suppression activities, thinning, and prescribed fires. **It is important to note, however, that fuels treatments under this alternative are not only intended to reduce risk of high intensity fire, they also represent a management tool required to restore much of the refuge's upland wildlife habitats to desired conditions (see Appendix 1).** Thus, while there may be short-term minor impacts, long-term and wildlife benefits of achieving desired habitat conditions are anticipated.

Habitat conditions for many wildlife species that inhabit ponderosa pine would improve with the restoration of the historic high-frequency, low-intensity fire regime characteristic of the ponderosa pine forest stands. Such a fire regime under which much of the native plant and animal community evolved would help restore and enhance the variety and diversity of native plant and wildlife habitats. Nutrients released to plants through the fertilization effects of ash would provide an important source of nutrition for wildlife in the area. While some trees would be killed from the effects of fire, these dead standing trees (snags) would be left as these provide important habitat for a variety of wildlife species.

Restoration to desired habitat conditions (Appendix 1) will likely result in some short-term impacts. The Partners in Flight Plan for the East Slope Cascades (Altman 2000) captures the essence of this issue:

“Meeting the goal of healthy landbird populations in the East Slope Cascades begins with the maintenance and restoration of functioning forest and non-forest ecosystems. Currently, considerable emphasis is being placed on restoration of these habitats to some semblance of pre-settlement conditions (approximately 1850). It is important to recognize that habitat alterations during restoration activities may temporarily or permanently displace landbird species currently using those areas. However, most degraded habitats tend to support habitat generalist species that are usually widespread and fairly common and not of high

conservation concern. Because of the degree of loss and degradation of most properly functioning ecosystems, restoration in many areas will be a long-term process.”

In the short- and long-terms, prescribed fire in ponderosa pine stands will increase the abundance of native grasses and forbs at the expense of shrubs. Bitterbrush, for example, is a shrub and is principle forage for big game species. Studies have demonstrated that big game species, such as mule deer, make heavy use of the more open, recently burned stands dominated by ponderosa pine (Peek et al, 1999). As the Fish and Wildlife Service implements hazardous fuels reduction treatments over time, a better diversity of age classes for the shrub component will emerge. To help ensure that wildlife, and big game in particular, have adequate abundance and variety of forage, the Fish and Wildlife Service will not employ prescribed fire and thinning activities on more than a third of the entire area in a single year. While individual animals or herds may travel with greater frequency on and off the refuge in search of areas with a higher shrub component in the understory, a decrease in shrub habitat as a food source for the big game species is not anticipated to significantly impact the viability of the populations or their ability to find plentiful food sources in and near the refuge.

Fire hazard reduction activities could result in the temporary displacement of wildlife or individual mortality of wildlife species. The loss of individual species, however, would not jeopardize the viability of the populations on and adjacent to the refuge. Thinning of the ponderosa pine stands would reduce the percentage of canopy closure and foster a more productive understory. Overall, hiding cover for mule deer, elk and other wildlife species in ponderosa pine stands may be reduced as a result of thinning activities; however, by 1) leaving ½-2 acre untreated clumps in high priority areas and 2) prohibiting thinning and prescribed fire activities between May 15 and July 15 in important calving and fawning grounds, impacts to mule deer and elk and their habitats would be minor and would not jeopardize the viability of the resident populations. In addition, thinning and prescribed fire activities may increase the forage quality and quantity available to mule deer and elk and enhance habitats for wildlife species which prefer these more open habitats (see Appendix 1 for focal species by habitat). The Fish and Wildlife Service will consult with the Klamath Tribes regarding important areas of hiding cover for mule deer and elk as well as the location of leave clumps in the various treatment areas.

Fire hazard reduction activities would benefit the bald eagle in a variety of ways. In the short-term, thinning and prescribed fire would remove hazardous fuels on the refuge and lessen the potential in the short-term that roost and nest trees would be destroyed in a large, high-severity fire. There would be the possibility of minor impacts to nesting eagles within the refuge; however, the refuge will consult under Section 7 of the Endangered Species Act to ensure these impacts are minimal. Any impacts would be temporary and minor in light of the mitigation measures to be employed during such activities (1/2 mile buffer from active nests and immediate cessation of work or suppression of prescribed fire in the event of a disturbance). In the long-term, thinning and prescribed fire would encourage the growth of large diameter ponderosa pine and would provide for future nesting and roosting habitat for the bald eagle.

Management activities during the early spring and late summer would likely impact some migratory birds nesting on the refuge, however, the limited extent of thinning operations to be conducted during the breeding season would not jeopardize the breeding population of a particular migratory bird species in the region. The Fish and Wildlife Service is currently developing procedures and policy guidance on the issue of protecting migratory birds. Any actions undertaken by the Fish and Wildlife Service under this alternative would be modified, if necessary, to be consistent with the procedures and recommendations that arise from the guidelines that are being developed (Laye, 2002).

Thinning and prescribed fire activities would not impact the yellow rail or the Oregon Spotted frog since these activities would not occur in the preferred habitat for these two species (the marsh) and would not occur for a majority of the breeding season (yellow rail).

3.4.2.3 Alternative 3

Under Alternative 3, wildlife impacts would be similar to those described under Alternative 2. In addition, thinning activities would reduce the extent of clumps (thickets) of ponderosa pine and lodgepole pine, which are preferred habitat for successful calving and fawning of big game species such as mule deer and elk on the refuge. Hiding cover at the forest edge of the marsh may also be reduced under this alternative. Extensive thinning in decadent lodgepole pine stands would reduce hiding cover for many animal species as well as reduce foraging habitat for several bird species such as three-toed, white-headed, and black-backed woodpeckers. While thinning treatments would result in the individual mortality of some wildlife species, the loss would not jeopardize the viability of the wildlife populations. There would not likely be direct mortality of larger mammals (coyote, mule deer and elk) during the fuel treatments since these animals would avoid treatment areas with on-going activities. The loss of hiding cover and treatments in calving and fawning grounds would likely result in a temporary shift in distribution of big game species as they moved to other areas within the refuge and off-refuge to locate desirable calving and fawning locations. Because there are adequate calving and fawning grounds, albeit not as "high-quality" as those found on the refuge, in adjacent private and public lands, treatments in the calving and fawning grounds are not anticipated to significantly impact the viability of the populations of big game species.

Yellow rail would not be affected under Alternative 3, however, there could be indirect, minor impacts to the stream habitats of Oregon spotted frog from thinning activities near stream and/or river banks (50-100 feet from surface water resources).

3.4.2.4 Alternative 4

General wildlife impacts under Alternative 4 would be similar to those described under Alternative 2, however, the absence of prescribed fire in the treatment units would result in higher levels of shrubs in the understory of the ponderosa pine and lodgepole pine forest communities. The increased forage would benefit big game species and improve nesting habitat for certain species of migratory birds.

3.5 AIR QUALITY

3.5.1 *Affected Environment*

Under the terms of the 1990 Clean Air Act amendments, the Klamath Marsh National Wildlife Refuge is designated as a Class II quality area. By definition, Class II areas of the country are set aside under the Clean Air Act, but identified for somewhat less stringent protection from air pollution damage than Class I areas. The primary means by which the protection and enhancement of air quality is accomplished is through implementation of National Ambient Air Quality Standards (NAAQS). These standards address six pollutants known to harm human health including ozone, carbon monoxide, particulate matter, sulfur dioxide, lead, and nitrogen oxides (USDA, 2000a). The City of Klamath Falls retains a non-compliance designation for particulate matter from air quality problems associated primarily with wood-burning stoves (Calkins, 2002).

3.5.2 *Environmental Consequences*

Air quality impacts were qualitatively assessed upon review Fish and Wildlife Service best management practices to reduce air emissions, State of Oregon prescribed fire procedural requirements, and the extent of proposed prescribed fire activities under all the alternatives. The Fish and Wildlife Service will quantify projected air emissions for any given prescribed fire prior to ignition.

3.5.2.1 Alternative 1 No Action

There would not be any direct air quality impacts under the No Action Alternative. In the absence of fire hazard reduction, air quality impacts from a high-severity wildfire would likely be greater than those experienced in treated forest stands.

3.5.2.2 Alternative 2 – Proposed Action

Smoke consists of dispersed airborne solids and liquid particles, called particulates, which could remain suspended in the atmosphere for a few days to several months. Particulates can reduce visibility and contribute to respiratory problems. Very small particulates can travel great distances and add to regional haze problems. Regional haze can sometimes result from multiple burn days and/or multiple owners burning within an airshed over too short a period of time to allow for dispersion.

Prior to any prescribed fire, the Fish and Wildlife Service must register the proposed burn with the Oregon Department of Forestry and provide information on several parameters, such as the location of the burn, expected size, fuel type(s), fuel loadings, etc. The Fish and Wildlife Service is responsible for preparing its own smoke management plan, a component that is not required by the State during the registration process. Following the prescribed fire, the agency must again

register results of the burn with the department. This information includes parameters such as total acreage burned and fuel moisture levels.

The Oregon Department of Forestry prepares prescribed fire burning instructions each day regarding weather conditions and recommended conditions for burning (e.g. maximum number of acres to be burned at a particular site, minimum spacing between fire sites, maximum tonnage of fuels to be burned, etc). The instructions are developed to help effectively manage smoke and resulting air quality impacts, as well as to provide information on fire conditions and danger. Recognition of the cumulative effects from multiple prescribed fires on any particular day(s) is embedded in the instructions. The advisories also discuss weather conditions and the potential for adequate smoke dispersion (Ziolko, 2002). Fish and Wildlife Service compliance with the advisories is voluntary, however, in the interest of human health and safety and compliance with Oregon and federal air quality laws, such as the Oregon Smoke Management Plan, the Fish and Wildlife Service will adhere to the burning instructions.

For prescribed fires, there are three principle strategies to manage smoke and reduce air quality effects. They include:

1. Avoidance - This strategy relies on monitoring meteorological conditions when scheduling prescribed fires to prevent smoke from drifting into sensitive receptors, or suspending burning until favorable weather (wind) conditions. Sensitive receptors can be human-related (e.g. campgrounds, schools, churches, and retirement homes) or wildlife-related (threatened and endangered species and their critical habitats);
2. Dilution – This strategy ensures proper smoke dispersion in smoke sensitive areas by controlling the rate of smoke emissions or scheduling prescribed fires when weather systems are unstable, not under conditions when a stable high-pressure area is forming with an associated subsidence inversion. An inversion would trap smoke near the ground; and
3. Emission Reduction – This strategy utilizes techniques to minimize the smoke output per unit area treated. Smoke emission is affected by the number of acres burned at one time, pre-burn fuel loadings, fuel consumption, and the emission factor. Reducing the number of acres that are burned at one time would reduce the amount of emissions generated by that burn. Reducing the fuel beforehand reduces the amount of fuel available. Prescribed burning when fuel moistures are high can reduce fuel consumption. Emission factors can be reduced by pile burning or by using certain firing techniques such as mass ignition.

If weather conditions changed unexpectedly during a prescribed burn, and there was a potential for violating air quality standards or for adverse smoke impacts on sensitive receptors, the refuge would implement a contingency plan, including the option for immediate suppression. Considering 1) the relatively small number of acres that would be affected by prescribed fire, approximately 3,400 acres at a maximum, 2) burning in the refuge would occur over at least a 5-year period, and 3) adherence to Oregon Department of Forestry burning instructions to minimize smoke emissions, prescribed burning would not violate daily national or state emission standards and would cause very minor and temporary air quality impacts.

3.5.2.3 Alternative 3

General air quality impacts under Alternative 3 would be similar to those described under Alternative 2.

3.5.2.4 Alternative 4

Under Alternative 4, there would be very minor air quality impacts from vehicles associated with thinning activities. In the absence of fire hazard reduction, air quality impacts from a high-severity wildfire would likely be greater than those experienced in treated forest stands.

3.6 NOISE

The loudest sounds that can be detected comfortably by the human ear have intensities that are 1 trillion (1,000,000,000,000) times larger than those of sounds that can just be detected. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes very unwieldy. As a result, a logarithmic unit known as the decibel (dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

Certain facilities, communities, and land uses are more sensitive to a given level of noise than others. Such “sensitive receptors” include schools, churches, hospitals, retirement homes, campgrounds, wilderness areas, and species of threatened or endangered wildlife. Impacts from noise production are generally assessed with respect to changes in noise levels experienced at sensitive receptors. Different types of sensitive receptors vary in their acceptance of noise disturbance. As a result, noise impacts for different receptors are often assessed using different noise level standards.

3.6.1 *Affected Environment*

There are several potential noise sources associated with thinning and prescribed fire activities for all the action alternatives. The dB sound levels from the equipment at a distance of 50’ includes the following: chainsaw (78 dB), harvester/forwarder (86 dB), and engine/truck (91 dB). While there are no campgrounds, churches, wilderness, or other related sensitive receptors in or immediately adjacent to the refuge, several known bald eagle nesting sites are located in the Winema National Forest adjacent to the refuge boundaries.

3.6.2 *Environmental Consequences*

Noise impacts were qualitatively assessed with respect to the location of sensitive receptors and mitigation measures.

3.6.2.1 Alternative 1 – No Action

There would not be any noise-related impacts under the No Action Alternative.

3.6.2.2 Alternative 2 – Proposed Action

There would be the possibility of minor impacts on nesting eagles within the refuge if thinning and/or prescribed fire activities were conducted on some stands during the early spring and late summer. Any impacts would be minor in light of the mitigation measures to be employed during such activities (1/2 mile buffer, immediate cessation of work or suppression of prescribed fire in the event of a disturbance). By prohibiting thinning activities from occurring in important calving and fawning grounds between May 15 and July 15 and within 100 feet of surface water resources, there would be either no impact, or a minor impact on nesting yellow rails by increased noise levels.

The general public would not be exposed to continual sound levels greater than 90 dB, however equipment workers may experience levels greater than 90 dB. Those workers operating the equipment would be required to mitigate any possible adverse noise impacts by using noise reduction devices such as earplugs.

3.6.2.3 Alternative 3

General noise impacts under Alternative 3 would be similar to those described under Alternative 2.

3.6.2.4 Alternative 4

General noise impacts under Alternative 4 would be similar to those described under Alternative 2.

3.7 RECREATION

3.7.1 *Affected Environment*

Klamath Marsh National Wildlife Refuge provides recreational opportunities including wildlife viewing, hiking, non-motorized boating (canoeing), and waterfowl hunting. In 2000, approximately 6,000 people visited the refuge. Peak visitation occurs between May-July. The predominant recreation activity on the refuge is wildlife observation, however waterfowl hunting in the fall and winter months is popular. Approximately 350 people participated in the waterfowl hunting season (September-January) in 2000. There are a few roads on the refuge that provide access to picnicking areas, a boat ramp, and wildlife observation areas.

Treaty rights afforded to members of the Klamath Tribes provide for hunting, fishing, and trapping activities on the refuge. Among subsistence activities, big game hunting (mule deer and Rocky Mountain elk) is an important traditional activity of the Tribe.

3.7.2 *Environmental Consequences*

Recreation impacts were qualitatively assessed in light of the intensity and duration of fire hazard reduction activities as they related to visitor use and experience. Visual resource impacts in this environmental assessment were assessed in terms of scenic integrity, visual wholeness, and unity of the landscape. A view with high scenic integrity is ecologically intact; it has few if any discordant elements in sight and contains only positive human elements. In contrast, a view of low scenic integrity has discordant and contrasting features such as geometric shapes (e.g. clearcuts), structures that do not blend with their surroundings, or roads that create large cut and fill slopes (Galliano and Loeffler, 2000).

3.7.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct impacts to recreation activities and opportunities, scenic integrity, or waterfowl and big game hunting. In the event of a high-severity fire occurring in refuge stands that did not receive fire hazard reduction treatments, particularly in the northern reaches of the refuge (treatment units 4, 7, and 8), important calving and fawning grounds may be destroyed. Depending on the severity of the loss of calving and fawning grounds, hunting of big game species on the refuge by tribal members may be adversely affected.

3.7.2.2 Alternative 2 – Proposed Action

There would be some short-term reduction in scenic integrity and visitor use and experience during and immediately following any thinning or prescribed fire activities from the presence of thinning or fire crews. Short-term reduction in scenic integrity, however, would be minor because 1) thinning and prescribed fire activities would involve only short-term presence of vehicles and people, 2) stumps would be cut flush with the ground, 3) smoke accumulation would be temporary since prescribed fires would be ignited under favorable conditions for smoke dispersion. Any prescribed fires would likely produce short-term smoke accumulations that impact local visual quality. Minimizing smoke emissions through best management practices would reduce any short-term impacts.

Visitor use would also be temporarily affected under this alternative when crews were conducting thinning and prescribed fire activities near hiking trails, canoeing areas, or wildlife observation areas. Access to areas where treatments were occurring could be temporarily restricted. Since thinning and prescribed fire treatments would be extremely limited during times of peak visitation on the refuge (May through July), any recreation impacts would be minor.

Similarly, fire hazard reduction efforts could have minor effects on big game hunting on the refuge by members of the Klamath Tribes. In those areas where treatments were occurring, big game species would be temporarily displaced. Tribal members would still be able to pursue their treaty right of big game hunting in other areas of the refuge not affected by on-going fire hazard reduction activities. This impact would be minor since fuel treatments would be short-term in nature and since the Fish and Wildlife Service will not employ prescribed fire and thinning activities on more than a third of the larger treatment areas in a single year. A decrease in the shrub component of the understory in ponderosa pine stands may result in a temporary shift in

distribution of some big game animals to other areas on and off the refuge. This distribution shift would have a minor impact to big game hunting by tribal members since animals would remain on the refuge to forage those areas not yet treated, or those areas that had not been treated for many years. While forage would still be available on the refuge despite the hazardous fuel treatments, the numbers of individuals it would support (carrying capacity) may be less.

3.7.2.3 Alternative 3

General recreation impacts under Alternative 3 would be similar to those described under Alternative 2 with a few exceptions. Maximizing fire hazard reduction by not retaining thickets of trees (clumps) would adversely impact “high-quality” wildlife habitat necessary for big game calving and fawning, as well as hiding cover on the forest edge. The temporary loss of these areas would not significantly impact the viability of the populations of big game species, however, the activity would displace some animals to other less desirable areas on or adjacent to the refuge. Since big game would still frequent the refuge to forage in the forested and riparian areas (perhaps in smaller numbers), the Tribe would still be afforded the ability to hunt big game.

3.7.2.4 Alternative 4

General recreation impacts under Alternative 4 would be similar to those described under Alternative 2, however, the absence of prescribed fire would eliminate minor impacts associated with smoke and the presence of fire crews.

3.8 TRANSPORTATION

3.8.1 *Affected Environment*

Military Crossing Road and the Silver Lake Highway are the principal roadways that provide access to the refuge. Scattered within and around the refuge are several unimproved Fish and Wildlife Service and Forest Service roads. The refuge currently supports approximately 3,400 visitors per year who recreate (wildlife observation) by vehicle, as well as approximately 2,600 additional visitors who access the refuge by vehicle for other recreation activities, such as waterfowl hunting and canoeing. Proposed thinning activities would require the use of the existing road network to access thinning areas with heavy equipment. Commercially valuable material may be removed on these roads using large trucks.

3.8.2 *Environmental Consequences*

3.8.2.1 Alternative 1 – No Action

There would not be any transportation related-impacts under the No Action Alternative.

3.8.2.2 Alternative 2 Proposed Action

Under this alternative, roads that are closed may be temporarily re-opened for the duration of treatment activities. There would be the potential for conflicts between vehicles associated with thinning efforts and visitor traffic on unimproved roads within the refuge. Impacts to visitor traffic would be minor however since thinning and prescribed fire activities would not occur during the majority of the peak tourist season (May through July). Additionally, heavy vehicle use would likely damage the secondary roads. To mitigate potential adverse impacts from vehicles associated with thinning activities, road improvements would be made as necessary to repair damage.

3.8.2.3 Alternative 3

General transportation impacts under Alternative 3 would be similar to those described under Alternative 2.

3.8.2.4 Alternative 4

General transportation impacts under Alternative 4 would be similar to those described under Alternative 2.

3.9 SOCIOECONOMICS

3.9.1 *Affected Environment*

Klamath Marsh National Wildlife Refuge is located in Klamath County, which has a population of 63,775 (USCB, 2001a). Approximately 44,000 people reside within the city limits and in the surrounding urban growth boundary of Klamath Falls (Klamath, 2001a). Agriculture, timber, and related businesses are major elements of the county's economy, as is transportation. Tourism is probably the fourth most important industry (SCORP, 1999). In addition to the refuge, several other National Wildlife Refuges, a Volcanic Scenic By-Way, Crater Lake National Park, and the Klamath Tribes Casino bring visitors to the county each year. Timber employment is not expected to increase in the near future, and the county looks to increasing economic diversification to aid economic growth. Tourism and recreation are an important part of this mix.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to identify and address any disproportionately high adverse human health or environmental effects of its projects on minority or low-income populations.

Minority populations constitute approximately 13% of the total population in this county. Using the Census Bureau's categories, the largest racial group is American Indian and Alaska native (4%), followed by those who said they were of two or more races (3%), and those who said they were some other race (3%). Asian, Black or African American, and Native Hawaiian groups

each made up less than 1% of the county's population. In addition, 8% of the population identified themselves as Hispanic or Latino; persons in this category can be of any race.

The median household income for Klamath County was \$23,054 in 1989 (USCB, 2001b). At that time, 9,494 of 56,707 individuals, or approximately 17%, were reported to be living in poverty in the county. The county reported an unemployment rate of 8.1% (Klamath, 2001b) significantly higher than the national average of 4.4% reported by the U.S. Bureau of Labor Statistics for May of 2001.

The Fish and Wildlife Service proposes to enter into contracts with outside parties to conduct thinning operations on the refuge. Thinning activities would not be performed under commercial contracts where the Fish and Wildlife Service would be paid for the value of any timber that was felled and removed. Rather, the Fish and Wildlife Service would pay the contractor(s) a fixed price per acre treated, to include a reduction in price for the expected commercial value of any timber in the areas to be treated. Estimates of stumpage value (value of the logs minus the logging costs) of timber at Klamath Marsh by the U.S. Forest Service range from \$120,000 to \$240,000 depending on how large an area is treated (Kilbury, 2002).

The Fish and Wildlife Service currently pays Klamath County a percentage of Klamath Marsh National Wildlife Refuges' appraisal value under 50 CFR Part 34, Refuge Revenue Sharing With Counties. Under this authority, the Fish and Wildlife Service must pay the county 25% of the net receipts from any revenue producing activity, such as the sale of timber from refuge lands if this amount is greater than the amount currently being paid. Depending on the amount of logging done and the net proceeds per year from the timber sale, the Fish and Wildlife Service may be required to pay additional dollars to Klamath County. These additional payments would only be required in the years that 25% of the net receipts exceed the normal payment schedule.

3.9.2 Environmental Consequences

Socioeconomic impacts were quantitatively assessed using U.S. Census Bureau data on personal income, population data, and poverty measures.

3.9.2.1 Alternative 1 – No Action

There would not be any direct socioeconomic impacts under the No Action Alternative. In the long-term, the absence of fire hazard reduction on the refuge could lead to high-severity fires that threaten Fish and Wildlife Service structures, as well as private residences adjacent to and near the refuge. Revenue sharing with Klamath County would not be affected under this alternative, nor would there be a highly disproportionate impact on minority or economically disadvantaged persons.

3.9.2.2 Alternative 2 – Proposed Action

Percentages of minority or economically disadvantaged persons in Klamath County are below the national averages for these categories, and the probability of a highly disproportionate impact

to these populations resulting from the implementation of fire hazard reduction activities would be minor. The Klamath Tribes are headquartered in Chiloquin, approximately 20 miles south of the refuge's boundary, and many of its members reside in Chiloquin and in areas south to Klamath Falls. In light of the distance separating the Tribe and the refuge, it is unlikely that a wildfire originating in the refuge would directly impact the community.

It is anticipated that any commercial operations to aid in thinning activities on the refuge would have a positive effect on the local economy, however, it is unclear whether timber that is removed would be processed in the local area or that new jobs would be created. Considering the DBH limits imposed by the Fish and Wildlife Service for the proposed activities and subsequent paucity of highly valued commercial timber, and considering the Fish and Wildlife Service's experience with similar contracts on the Bear Valley National Wildlife Refuge, it is not anticipated that the revenues generated from the contracts would represent greater than 2% of the local or regional economy, or that revenue sharing would dramatically increase with the County. It is anticipated that revenue sharing with the County would moderately increase under this alternative.

3.9.2.3 Alternative 3

General socioeconomic impacts under Alternative 3 would be similar to those described under Alternative 2, however, activities would result in larger numbers of trees being thinned.

3.9.2.4 Alternative 4

General socioeconomic impacts under Alternative 4 would be similar to those described under Alternative 2.

3.10 HUMAN HEALTH AND SAFETY

3.10.1 *Affected Environment*

Prior to the ignition of any prescribed fire in the refuge, all the burn parameters of the existing and approved prescribed fire burn plan must be met to ensure a safe and effective prescribed fire. In addition, staff would advise the public and adjacent landowners of the time and extent of the proposed burn. In the event of potentially hazardous escaped prescribed fire within the refuge, the refuge manager would coordinate public notification efforts. The extent of public notice would depend on the specific fire situation. In every case, assuring visitor and refuge staff safety would take priority over other activities.

3.10.2 *Environmental Consequences*

Human health & safety impacts were qualitatively assessed through determination of activities, equipment and conditions that could result in injury, literature review of type and extent of injury caused by equipment and conditions, and in light of mitigation measures and best management practices.

3.10.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct or short-term indirect human health and safety impacts. In the long-term, the absence of fire hazard reduction efforts would increase the potential for a high-severity, catastrophic wildfire that could adversely impact human health and safety. Current management actions would continue to put firefighters at risk in the absence of defensible space from which to fight wildfires and in the absence of hazardous fuels reduction treatments, which can lead to high-severity, catastrophic wildfires.

3.10.2.2 Alternative 2 – Proposed Action

Factors most likely to adversely impact firefighter health and safety include activities associated with prescribed fire and, if necessary, wildland fire suppression efforts (accidental spills, injuries from the use of fire-fighting equipment, smoke inhalation, and, in severe cases, injuries from prescribed or wildland fires). Impacts to the public could include smoke inhalation, and in severe cases, injuries from wildland fires.

Accidental spills of fire retardants and foams can adversely impact human health & safety. Fire retardants used in controlling or extinguishing fires contain about 85% water, 10% fertilizer, and 5% minor ingredients such as corrosion inhibitors and bactericides. Fire suppressant foams are more than 99% water. The remaining 1% contains surfactants, foaming agents, corrosion inhibitors, and dispersants. These qualified and approved wildland fire chemicals have been tested and meet specific requirements with regard to mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests (USDA, 2001). However, they are strong detergents, and can be extremely drying to skin. All currently approved foam concentrates are irritating to the eyes as well. Application of a topical cream or lotion can alleviate the effects of a retardant, and protective goggles can prevent any injury to the eyes when using foams.

Fire line construction can pose safety threats to firefighters. Injuries can occur from the use of equipment as well as from traveling overland to targeted areas for firefighting efforts during suppression efforts. While each of the crew is trained in the use of firefighting equipment, accidental injuries may occur from time to time. Strict adherence to guidelines concerning firefighter accreditation, and equipment and procedure safety guidelines would minimize accidents.

Smoke inhalation can also pose a threat to human health & safety. Smoke from wildland fires is composed of hundreds of chemicals in gaseous, liquid, and solid forms. The chief inhalation hazard appears to be carbon monoxide (CO), aldehydes, respirable particulate matter with a median diameter of 2.5 micrometers (PM_{2.5}), and total suspended particulate (TSP). Adverse health effects of smoke exposure begin with acute, instantaneous eye and respiratory irritation and shortness of breath, but can develop into headaches, dizziness, and nausea lasting up to several hours. Based on a recent study of firefighter smoke exposure, most smoke exposures were not considered hazardous, but a small percentage routinely exceeded recommended exposure limits for carbon monoxide and respiratory irritants (USDA, 2000b).

Use restrictions applied to areas of wildland fires or prescribed fires would minimize or eliminate public human health & safety concerns resulting from smoke exposure and fire injuries. When using prescribed fire, mitigation measures, such as construction of fire lines, the presence of engines, and strict adherence to prescribed burn plans, would minimize the potential for an out-of-prescription burn or escape. Elements of the prescribed burn plan that relate to ensuring a safe burn include such measures as fuel moisture, wind speed, rate of fire spread, and estimated flame lengths. While the potential for a fire escape will always exist when conducting prescribed fires, that potential is extremely small. Recent statistics summarized by the Boise Interagency Fire Center report that approximately 1% of prescribed fires on federal lands required suppression activities of some kind. In most cases these prescribed fires jumped a control line and suppression tactics were successfully used to control them. Out of the 1% of prescribed fires that required suppression, 90% were controlled without incident. Statistically, this result leaves about 0.1% of prescribed fires that required major suppression actions (Stevens, 2000).

3.10.2.3 Alternative 3

The general impacts to human health & safety under Alternative 3 would be similar to those described under Alternative 2.

3.10.2.4 Alternative 4

The general impacts to human health & safety under Alternative 4 would be similar to those under Alternative 2. The exclusion of prescribed fire (broadcast burning) to reduce ground fuels would eliminate the possibility of an out-of-prescription burn or fire escape. Since slash pile burning would be conducted during winter, the potential for escape from a slash pile burn and for a subsequent wildfire would be very low. In the long-term, however, fuels buildup in the absence of prescribed fire would result in more intense and severe wildland fires that could be more difficult to suppress.

3.11 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their proposals on historic properties, and to provide state historic preservation officers, tribal historic preservation officers, and, as necessary, the Advisory Council on Historic Preservation a reasonable opportunity to review and comment on these actions.

3.11.1 *Affected Environment*

Based on a 2001 cultural resources survey of the proposed treatment areas in Klamath Marsh National Wildlife Refuge, seventeen archeological sites (15 aboriginal/prehistoric, 1 historic, and 1 historic/prehistoric) were identified and recorded. An additional twenty-one isolated finds (18 aboriginal/prehistoric, 3 historic) were identified and recorded. All sites are considered sacred by the Klamath Tribes, and the entirety of the refuge is currently being considered as an archeological district (Zerga, 2002).

Archeological sites are divided into two types: housepits, containing distinct housepit depressions; and lithic sites, having no housepits and containing stone artifacts and features including flaked stone, groundstone, stone rings and rock cairns. This site type division is based on interpretation of housepit sites as winter or permanent habitation areas. Lithic or non-housepit sites are interpreted as temporary or seasonal camps, although winter habitation at these areas has not been ruled out. Housepit and lithic sites are found on both the north and south sides of the marsh, but the vast majority of housepit sites are located on the south end (Sobel, 1992).

Protection measures for sites are keyed to determinations of each site's eligibility for inclusion in the National Register of Historic Places. Officially listed heritage sites and sites determined eligible or with an undetermined eligibility are of concern. Ineligible sites are dropped from management concerns, and determinations of effect on these properties are not addressed in this analysis.

3.11.2 Environmental Consequences

Cultural resource impacts were qualitatively assessed through a presence/absence determination of significant cultural resources and mitigation measures to be employed during thinning and prescribed fire activities.

3.11.2.1 Alternative 1 – No Action

Under the No Action Alternative, there would not be any direct impacts to cultural resources. The absence of fire hazard reduction in the refuge, and the corresponding fuels buildup, would result in more intense and severe wildland fires, which have an increased potential for affecting cultural resource sites, especially any historic sites with exposed burnable material (wood).

3.11.2.2 Alternative 2 – Proposed Action

Proposed activities with the potential to impact cultural resources include building fire lines, thinning, and prescribed fire. Prior to any construction of fire lines or thinning and prescribed fire activities, treatment areas would be surveyed and cultural resources would be identified and recorded via consultations with Service and Tribal archeologists.

Sites that could be potentially affected during thinning, fire line construction and slash piling would be avoided to eliminate potential damage. Site boundaries would be clearly marked for avoidance, and sites would be monitored during and after completion of the activities. Because these sites would be avoided, there would be no effect to these cultural resource sites.

Sites with combustible materials (i.e. exposed wood) will be avoided during prescribed fires. A fire line would be built around the perimeter of these sites. Fuels would be removed from the interior of the sites and from the area surrounding the site to maintain low burn temperatures. Back burning may also take place around the site to reduce fuel loading and to lessen the degree of direct heat.

There would be the potential for fire hazard reduction activities to affect unrecorded cultural resources within the refuge. Since many of the cultural resources can be found adjacent to the marsh and within riparian areas, the 100-foot riparian buffer for mechanical thinning activities would provide additional mitigation for preventing impacts to unrecorded sites.

Since cultural sites will be avoided, hazardous fuel treatments will not affect the qualities of the refuge that make it eligible for national register listing as an archeological district.

3.11.2.3 Alternative 3

General impacts to cultural resource sites under Alternative 3 would be similar to those described under Alternative 2. In addition, there would be an increased potential for affecting unrecorded cultural resources within 100 feet of riparian areas.

3.11.2.4 Alternative 4

Impacts to cultural resource sites from thinning activities would be similar to those described under Alternative 2. In addition, the absence of prescribed fire in the refuge, and the corresponding fuels buildup would result in more intense and severe wildland fires, which have an increased potential for affecting cultural resource sites. As with the other action alternatives, there would be the potential for fire management activities affecting unrecorded cultural resource sites.

3.12 CUMULATIVE EFFECTS

The cumulative effects analysis for this Environmental Assessment considers the past, present, and reasonably foreseeable future actions on land uses that could add to (intensify) or offset (compensate for) the effects on the resources and that may be affected by the alternatives. Cumulative effects vary by resource and the geographic areas considered here are generally the Refuge and areas adjacent to the refuge. In some instances, activities may result in both negative and positive impacts when considering the short and long-terms. As a result, some resource categories in Table 3-1 show both positive and negative impacts resulting from a particular activity. The information provided in Table 3-1 is the basis for the cumulative effects described in Table 3-2.

Table 3-1 Affected Impact Topics and Activities/Land Uses
Contributing to Fire Hazard Reduction Cumulative Effects

	Soils	Water Resources	Vegetation	Wildlife	Air Quality	Noise	Recreation	Trans.	Socio-economics	Human Health & Safety	Cultural Resources
Past, present, and future marsh prescribed fires on the refuge		+	+-	+-	-		+-		+	+-	
Lightning & human-caused wildfires	+-	+-	+-	+-	-		+-	-	-	+-	-
Wildfire suppression past, present, future	-	-	+-	+-	+	-	+-		+	+	+-
Past, present, and future logging, haying, pesticide application, and grazing on the refuge	+-	-	+-	+-		-	+-	-	+	-	-
Past, present, and future water management	-	-	+-	+-			+-		+-		+-
Past, present and future prescribed fire and logging activities in the Winema National Forest	+-	+-	+-	+-	-	-	+-		+	+-	+-
Waterfowl and subsistence hunting on the refuge				+-		-	+		+		
Road improvements on the refuge	+-	+-	-	-	+	-	+	+	+	+	-
Visitation on the refuge					-	-	+		+		-

DIRECT/INDIRECT EFFECTS KEY: (+) Positive/beneficial; (-) Negative/detrimental; (Blank) Neutral/no effect

Table 3-2 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Soils	Adverse soil impacts (soil erosion or loss) from past and present road construction, logging, grazing and haying activities, wildland fires and suppression efforts; Beneficial soil impacts from past wildland fires (nutrification of soils)	Prescribed fire and thinning activities would have temporary and minor adverse effects on soils (soil erosion and compaction), but beneficial effects as well over the short and long-terms (soil development and soil nutrification)	Suppression efforts to contain large wildfires could adversely impact soils (compaction, erosion from firebreaks, etc.); future road improvements, grazing, and haying activities impact soils	Some soils inside of the refuge would improve over time with soil development and nutrification from prescribed fires while others continue to be degraded by other management activities; Fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 and 3 would contribute the most to soil cumulative impacts, while Alternative 1 would contribute the least
Water Resources	Significant impacts to water resources from past water management; past and current logging, grazing, haying, and pesticide applications impacts water resources (bank destabilization, sedimentation, turbidity, alteration of stream channels)	Thinning and prescribed fires would have very minor direct impacts on water resources	Future water management, haying, grazing, and pesticide applications will continue to impact water resources	Very minor effect on water resources; Fire hazard reduction would not result in significant cumulative impacts; Alternative 3 would contribute the most to water resource cumulative impacts, while Alternative 1 would contribute the least
Vegetation	Natural fuel loading increased in absence of historic low-severity, high frequency fire regime; past logging and wildfire suppression lead to decline in native plant habitat and diversity, transition from fire tolerant plant species to fire intolerant plant species, increased canopy closure, and reduced forest stands with old growth characteristics	Thinning and prescribed fire would decrease hazardous fuel loadings; native grass and forb species would be favored in the understory; forest stand structure in some areas would return to historic conditions; aspen stand development would be benefited; encroachment of conifers in dry meadows would be stopped.	Thinning and prescribed fire efforts in the Winema National Forest would reduce fuel loadings and help restore historic fire regime to adjacent ponderosa pine and mixed conifer stands; wildland fire suppression efforts continue to alter historic fire regime for ponderosa pine and lodgepole pine forest communities	Ponderosa pine community and habitat diversity would continue to improve; fuel loadings would pose a reduced fire danger; fire hazard reduction would not result in significant cumulative impacts; Alternative 3 would contribute the most to vegetation cumulative impacts, while Alternative 1 would contribute the least

Table 3-2 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Wildlife	Fire suppression efforts within the refuge degraded fire-tolerant wildlife habitat and diversity	Thinning and prescribed fire would result in minor, short-term disturbance and displacement with minimal species loss; improved habitat and increased wildlife diversity with restoration of historic fire regime; very minor or no impacts on threatened and endangered species	Thinning and prescribed fire efforts in the Winema National Forest would help restore historic fire regime to adjacent ponderosa pine stands and benefit wildlife habitat and species diversity; commercial logging operations and associated prescription treatments in adjacent forest service lands may degrade wildlife habitat for some species	Wildlife habitat and diversity increases; fire hazard reduction does not result in significant cumulative impacts; Alternative 3 would contribute the most to wildlife cumulative impacts, while Alternative 1 would contribute the least
Air Quality	Past wildland and prescribed fires on and off the refuge contribute to temporary deterioration in air quality and visibility; minor emissions from vehicle traffic (local and tourist)	Prescribed fire emissions would result in minor, short-term air quality and visibility impacts	Future wildland fires and prescribed fires on adjacent forest service lands would contribute to temporary deterioration in air quality and visibility	Air quality standards would not be violated; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 and 3 would contribute the most to air quality cumulative impacts, while the No Action Alternative and Alternative 4 would contribute the least
Noise	Past and present hunting resulted in short-term noise impacts; traffic associated with visitation of the refuge continues to be a long-term source of noise; thinning and logging activities on adjacent forest service lands result in noise impacts	Thinning and suppression activities would result in temporary, but insignificant, noise impacts to sensitive receptors (nesting/roosting bald eagles, forest birds)	Hunting and traffic associated with visitation of the refuge continues to be a long-term source of noise; thinning and/or commercial logging on adjacent forest service lands will result in noise impacts	Noise sources and levels in the refuge would increase in the short-term; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2, 3, and 4 would result in similar noise impacts, while the No Action Alternative would result in the least
Recreation	Establishment of the refuge, roads and trails provided access for recreation opportunities; increased population growth results in increased recreational use; past and present waterfowl hunting provide continued recreation opportunity	Very minor visitor use and experience impacts resulting from thinning and prescribed fire activities;	Increased recreation use as population grows; road improvement would likely increase recreational use of Wocus Bay area	Long-term enhancement of recreation resources and opportunities offsets short-term recreation inconveniences from fuel treatments; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2 and 3 would contribute the most to recreation cumulative impacts, while the No Action Alternative would contribute the least

Table 3-2 Cumulative Effects

Resource	Past and Present Actions	Proposed Actions	Future Actions	Cumulative Effects
Transportation	Fish and Wildlife Service and Forest Service roads improve access to the refuge	Very minor conflicts with thinning and prescribed fire activities and recreation traffic; minor damage to existing un-improved access roads	Road improvement on Fish and Wildlife Service road to Wocus Bay benefits access to area	Minor conflicts between management and recreation traffic during thinning and prescribed fire activities; fire hazard reduction would not result in significant cumulative impacts; Alternatives 2, 3, and 4 would result in similar transportation impacts, while the No Action Alternative would result in the least
Socio-economics	Past and present grazing, haying, hunting, and wildland fire suppression activities contribute to beneficial socioeconomic impacts; timber harvests in Winema National Forest provide revenue to local economy	Minor impacts to local and regional economies from thinning activities	Similar effects as described in Past and Present Actions	Thinning activities result in minor impacts to local and regional economy; fire hazard reduction would not result in significant cumulative impacts; Alternative 3 would contribute the most to socioeconomic impacts while the No Action Alternative would contribute the least
Human Health & Safety	Past wildland fire suppression efforts on the refuge and adjacent Forest Service lands protected refuge staff, visitors, and adjacent residents	Thinning and prescribed fire activities may result in very minor impacts; long-term improvement in human health & safety with reduction in hazardous fuels	Similar effects as described in Past and Present Actions	Human health and safety would improve over time with thinning and prescribed fire activities; fire hazard reduction would not result in significant cumulative impacts; the No Action Alternative and Alternative 4 would contribute the most to adverse human health and safety cumulative impacts, while Alternatives 2 and 3 would contribute the most beneficial cumulative impacts
Cultural Resources	Establishment of the refuge helped protect cultural resources; past suppression efforts may have impacted un-recorded sites; access roads and visitation on refuge may have facilitated the illegal taking of some cultural resources	Fire hazard reduction treatments could result in impacts to un-recorded sites	Similar effects as described in Past and Present Actions	Cultural resources continue to be protected; fire hazard reduction would not result in significant cumulative impacts; Alternative 3 would contribute the most to cultural resources cumulative impacts, while the No Action Alternative would contribute the least

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Scoping

Details of the scoping process and the issues that arose from it are described in Chapter 1, Section 1.4 – *Scoping Issues and Impact Topics*.

References Cited

- (Altman, B. 2000). Conservation strategy for landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington, Partners in Flight, Ver. 1.0. American Bird Conservancy, Boring, Oregon.
- (Calkins, 2002). Oregon Department of Environmental Quality. 5 March 2002. Personal communication with Larry Calkins.
- (Collom, 2002) Oregon Dept. of Fish and Wildlife. 2 May 2002. Personal communication with Tom Collom.
- (Dahms and Geils, 1997). Dahms, C.W. and B.W. Geils (eds.). 1997. An Assessment of Forest Ecosystem Health in the Southwest. United States Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. General Technical Report. RM-GTR-295.
- (Fiddler et. al. 1989). Fiddler, G.O., D.R. Hart, T.A. Fiddler, and P.M. McDonald. 1989 Thinning decreases mortality and increases growth of ponderosa pine in northeastern California. U.S. Department of Agriculture Forest Service Research Paper PSW-194.
- (Galliano and Loeffler, 2000). Galliano, S.J. and G.M Loeffler. 2000. Scenery Assessment: Beauty at the Ecoregion Scale. United States Department of Agriculture, Pacific Northwest Research Station. General Technical Report. PNW-GTR-472.
- (Goheen, 2002a). Klamath Basin National Wildlife Refuge Complex. 20 February 2002. Personal communication with David Goheen.
- (Goheen, 2002b). Klamath Basin National Wildlife Refuge Complex. 1 March 2002. Personal communication with David Goheen.
- (Johnson, 2002) U.S. Department of Fish and Wildlife Service. 7 March 2002. Personal communication with Sam Johnson.
- (Kilbury, 2002). United States Forest Service. 8 May 2002. Personal communication with Richard Kilbury.
- (Klamath, 2001a). The City of Klamath Falls, Oregon. City Profile. Web page. Date accessed: 27 July 2001. Accessed at: <http://www.ci.klamath-falls.or.us>
- (Klamath, 2001b). Oregon Chamber of Commerce, Klamath County. 2001. Unemployment Rates. Web page. Date accessed: June 2001. Accessed at: <http://www.klamath.org>
- (Laye, 2002). United States Fish and Wildlife Service. 27 February 2002. Personal communication with Douglas Laye.

(Lundquist, 1993). Lundquist, J.E. 1993. Large scale spatial patterns of conifer diseases in the Bighorn Mountains, Wyoming. United States Department of Agriculture Forest Service Research Note RM-523.

(McCambridge and Stevens, 1982). McCambridge, W.F. and R.E. Stevens. 1982. Effectiveness of thinning ponderosa pine stands in reducing mountain pine beetle-caused tree losses in the Black Hills – preliminary observations. U.S. Department of Agriculture Forest Service Research Note RM-414.

(McCoy et al., 2001). McCoy, L., K. Close, J. Dunchrack, S. Husari, and B. Jackson. May 6 – 24, 2000. Cerro Grande Fire Behavior Narrative.

(Patterson, 1992). Patterson, S. 1992. Douglas-fir beetle: dealing with an epidemic. Pages 73-76 in D. Murphy, Comp., Getting to the future through silviculture – workshop proceedings. U.S. Department of Agriculture Forest Service General Technical Report INT-291.

(Peek et al, 1999). Peek, J.M., J.A Korol, and B.C. Dennis. 1999. A review and analysis of habitat relationships and mule deer populations in south-central Oregon. Univ. of Idaho. Moscow, Idaho.

(SCORP, 1999). South Central Oregon Regional Partnership. Strategic Plan 1999. Web page. Date accessed: 08 June 2001. Accessed at: <http://www.sobusi.com/scorp>

(Sobel, 1992). Sobel, E. 1992. Background and preliminary inventory of archeological and traditional cultural properties at Klamath Marsh, Klamath County, Oregon. U.S. Fish and Wildlife Service. Chiloquin, Oregon.

(Stevens, 2000). Stevens, Scott L. 07 June 2000. Congressional Testimony on Reducing Fire Hazard in Coniferous Forests and in the Urban-Wildland Intermix.

(USCB, 2001a). United States Census Bureau. Census 2000 Quick Facts. Web page. Date accessed: 08 June 2001. Accessed at: <http://factfinder.census.gov/qfd/states/41/41035.html>

(USCB, 2001b). United States Census Bureau. 1990 Census of Population and Housing. Web page. Date accessed: 08 June 2001. Accessed at: <http://factfinder.census.gov>

(USDA, 2000a). United States Department of Agriculture, Forest Service. April 2000. *Incorporating Air Quality Effects of Wildland Fire Management into Forest Plan Revisions – A Desk Guide (Draft)*.

(USDA, 2000b). United States Department of Agriculture, Forest Service, Pacific Northwest Research Station. July 2000. Smoke Exposure at Western Wildfires. Research Paper. PNW-RP-525.

(USDA, 2001). United States Department of Agriculture, Forest Service. Wildland Fire Suppression Chemicals Toxicity and Environmental Issues and Concerns. Web page. Date accessed: 06 June 2001. Accessed at: http://www.fs.fed.us/rm/fire/The_Environment.html

(USFS, 2000a). United States Department of Agriculture, Forest Service. March 2000. Interior Columbia Basin Supplemental Draft Environmental Impact Statement.

(USFS, 2000b). United States Department of Agriculture, Forest Service. October 2000. Scott Able Fire Forest Health Project Environmental Assessment. Alamogordo, New Mexico.

(USFS, 2001). United States Department of Agriculture, Forest Service. Wildland Urban Interface. Web page. Date accessed: 25 September 2001. Accessed at: <http://www.fs.fed.us/r3/sfe/fire/urbanint.html>

(USFWS, 1987). U.S. Fish and Wildlife Service. 1987. Klamath Forest National Wildlife Refuge – Management Plan. Tulelake, California.

(USFWS, 1989). U.S. Fish and Wildlife Service. 1989. Klamath Forest National Wildlife Refuge Habitat Management Plan. Tulelake, California.

(Vogl, 1979). Vogl, R.J. Some basic principles of grassland fire management. *Environmental Management* 3(1):51-57, 1979.

(Williamson River Watershed, 1999?)

(Wright and Bailey, 1980). Wright, H.A. and A.W. Bailey. 1980. Fire ecology and prescribed burning in the Great Plains – A research review. United States Department of Agriculture, Forest Service, Intermountain Forest Range Experiment Station, Ogden, Utah. General Technical Report. INT-77.

(Zerga, 2002) D.L. Zerga & Associates. 7 March 2002. Personal communication.

(Ziolko, 2002) Oregon Department of Forestry. 25 February 2002. Personal communication with Michael Ziolko.

GLOSSARY OF TERMS

Backfiring: When attack is indirect, intentionally setting fire to fuels inside the control line to contain a rapidly spreading fire. Backfiring provides a wide defense perimeter, and may be further employed to change the force of the convection column.

Basal Area: The amount of square footage in a forest stand at 4 1/2 feet above the ground.

Burning Out: When attack is direct, intentionally setting fire to fuels inside the control line to strengthen the line. Burning out is almost always done by the crew boss as a part of line construction; the control line is considered incomplete unless there is no fuel between the fire and the line.

Contingency Plans: Provides for the timely recognition of approaching critical fire situations and for timely decisions establishing priorities to resolve those situations.

Control Line: An inclusive term for all constructed or natural fire barriers and treated fire edge used to control a fire.

Crew: An organized group of firefighters under the leadership of a crew boss or other designated official.

Crown Fire: A fire that advances from top to top of trees or shrubs more or less independently of the surface fire. Sometimes crown fires are classed as either running or dependent, to distinguish the degree of independence from the surface fire.

Duff: The partially decomposed organic material of the forest floor beneath the litter of freshly fallen twigs, needles, and leaves.

Ecosystem: An interacting system of interdependent organisms and the physical set of set of conditions upon which they are dependent and by which they are influenced.

Fire Behavior Forecast: Fire behavior predictions prepared for each shift by a fire behavior analysis to meet planning needs of fire overhead organization. The forecast interprets fire calculations made, describes expected fire behavior by areas of the fire, with special emphasis on personnel safety, and identifies hazards due to fire for ground and aircraft activities.

Fire Behavior Prediction Model: A set of mathematical equations that can be used to predict certain aspects of fire behavior when provided with an assessment of fuel and environmental conditions.

Fire Danger: A general term used to express an assessment of fixed and variable factors such as fire risk, fuels, weather, and topography which influence whether fires will start, spread, and do damage; also the degree of control difficulty to be expected.

Fire Ecology: The scientific study of fire's effects on the environment, the interrelationships of plants, and the animals that live in such habitats.

Fire line: The part of a control line that is scraped or dug to mineral soil.

Fire Management: The integration of fire protection, prescribed fire and fire ecology into land use planning, administration, decision making, and other land management activities.

Fire Occurrence: The number of wildland fires started in a given area over a given period of time. (Usually expressed as number per million acres.)

Fire Prevention: An active program conducted in-park and in conjunction with other agencies to protect human life, prevent modification, of the park ecosystem by human-caused wildfires, and prevent damage to cultural resources or physical facilities. Activities directed at reducing fire occurrence, including public education, law enforcement, personal contact, and reduction of fire risks and hazards.

Fire Retardant: Any substance that by chemical or physical action reduces flammability of combustibles.

Fire Risk: The probability that a wildfire will start as determined by the presence and activities of causative agents.

Fuel: The materials which are burned in a fire; duff, litter, grass, dead branchwood, snags, logs, etc.

Fuel Loading: Amount of dead fuel present on a particular site at a given time; the percentage of it available for combustion changes with the season.

Fuel Type: An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Heavy Fuels: Fuels of a large diameter, such as snags, logs, and large limbwood, which ignite and are consumed more slowly than flash fuels.

Human-Caused Fires: Refers to fires ignited accidentally (from campfires or smoking) and by arsonists; does not include fires ignited intentionally by fire management personnel to fulfill approved, documented management objectives (prescribed fires).

Intensity: The rate of heat energy released during combustion per unit length of fire edge.

Inversion: Atmospheric condition in which temperature increases with altitude.

Ladder Fuels: Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

Litter: The top layer of the forest floor composed of loose debris, including dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Monitoring Team: Two or more individuals sent to a fire to observe, measure, and report its behavior, its effect on resources, and its adherence to or deviation from its prescription.

Prescribed Fire: The skillful application of fire in a definite area under predetermined weather and fuel conditions to achieve specific management objectives.

Prescription: A written statement defining the objectives to be attained, the conditions of temperature, humidity, wind direction and speed, fuel moisture, etc.

Reburn: Subsequent burning of an area in which fire has previously burned but has left flareable light that ignites when burning conditions are more favorable.

Surface Fire: Fire which moves through duff, litter, woody dead and down, and standing shrubs, as opposed to a crown fire.

Wildfire: An unwanted wildland fire.

Wildland Fire: Any non-structure fire, other than prescribed fire, that occurs in the wildland. This includes both prescribed natural fires and wildfires.

Appendix I

Desired Upland Habitat Conditions and Treatment/Restoration Options - Klamath Marsh NWR

Background

The Partners in Flight (PIF) East Slope Cascade Mountains Bird Conservation Plan (Oregon and Washington) (Altman 2000) was used in part to develop desired habitat conditions for forested and forest/meadow habitats at Klamath Marsh NWR. This plan outlines management approaches that will increase habitat variability and carrying capacity for numerous wildlife species, promote restoration of forest complexity and forest health, and reduce overall fuel levels and continuity. The PIF Plan describes current habitat conditions, prioritizes habitats for restoration, and identifies focal bird species within the landscape, of which Klamath Marsh NWR is a part. In this instance, focal bird species also serve as indicators of habitat health. Focal bird species identified in the PIF Plan are habitat specialists, meaning they have very specific habitat requirements. Species such as mule deer are habitat generalists, able to use a variety of habitats as long as a few key requirements are met. When robust populations of indicator species are present, habitat generalists tend to benefit as well. Niches for habitat specialists are provided when a variety of habitats exist across the landscape. In addition, habitat generalists benefit to great extent because they are often able to make use of multiple habitats. The following narrative from the PIF Plan describes conditions within this geographic area:

“Vegetation of the East-Slope Cascades has changed in the last 150 years since European settlement of the region. Primary changes have been the loss of old forest habitat due to intensive timber harvesting, and the degradation of habitats (eg., Ponderosa pine forest) from a number of factors including fire suppression, over-grazing, invasion of exotic vegetation, and human development. The loss and alteration of historic vegetation communities has impacted landbird habitats and resulted in species range reduction, population declines, and some local and regional extirpations.”

The following discussion of habitat and wildlife objectives and restoration options is organized around desired future conditions. These desired habitats include open Ponderosa pine, old growth lodgepole, wet and dry meadows, and vigorous aspen stands. In general, treatment units identified in the Environmental Assessment contain or are restorable to one or more of these habitats, thus more than one treatment option may occur in a particular unit. For example, Unit 6 has a meadow edge component that may require spring or fall prescribed fire to set back encroaching lodgepole saplings. Over stocked Ponderosa pine exists at slightly higher elevations that will require thinning, treatment of slash, and prescribed fire, and scattered aspen stands occur throughout that will require some form of disturbance. The following desired conditions and treatment/restoration options were developed using input from the Klamath Tribes, Klamath Bird Observatory, and the U.S. Forest Service. Treatments in some areas may require modification to protect cultural resources and/or the subsistence rights of the Klamath Tribes. Coordination with the Tribes will be required for successful implementation of treatment/restoration activities.

Restoration to desired future condition will likely result in some short-term impacts. The PIF for the East Slope Cascades captures the essence of this issue:

“Meeting the goal of healthy landbird populations in the East Slope Cascades begins with the maintenance and restoration of functioning forest and non-forest ecosystems. Currently, considerable emphasis is being placed on restoration of these habitats to some semblance of pre-settlement conditions (approximately 1850). It is important to recognize that habitat alterations during restoration activities may temporarily or permanently displace landbird species currently using those areas. However, most degraded habitats tend to support habitat generalist species that are usually widespread and fairly common and not of high conservation concern. Because of the degree of loss and degradation of most properly functioning ecosystems, restoration in many areas will be a long-term process.”

Monitoring

If funding can be obtained, the Service through cooperators will monitor landbird response to habitat treatments conducted as part of this project. At Klamath Marsh there is a unique opportunity to integrate National Fire Plan objectives with those of the Refuge, and the Service. Management for the desired conditions will result in the reduction of fuel loads and fire danger, and habitat enhancement for fire associated wildlife. By associating current and desired conditions with PIF focal species, bird monitoring can be used to monitor the effectiveness of these treatments within the ecosystem management framework.

When considering the integration of National Fire Plan and Refuge objectives, it is clear that landbird monitoring is a cost-effective and flexible effectiveness monitoring tool. The advantages include that one or two methods effectively monitors a wide range of species, including habitat specialists, rare species, and those with a wide range of adaptations. Because of their rapid metabolism, and generally high position on food webs, landbirds are good indicators of the effects of environmental change (DeSante 1989). Most landbird species are dependent on specific habitat attributes. Habitat alterations, such as those brought about by forest management practices, have considerable potential to affect avian communities (Rosenstock 1996). The effect of management on habitat structure, floristic composition and food resources may be especially important, singly or in combination, as many birds respond strongly to these features in their habitats (Rotenberry 1985).

The PIF calls for monitoring components for Conservation Plan associated projects:

“Monitoring of habitat attributes and focal species will provide a means of tracking progress towards conservation. Monitoring will provide essential feedback for demonstrating adequacy of conservation efforts on the ground, and guide the adaptive management component that is inherent in this approach. When conservation actions are undertaken as described in this document, monitoring and/or research programs should be designed and implemented to test the effectiveness of management actions, evaluate

assumptions built into biological objectives, and direct adaptive management to achieve desired results. Monitoring will be essential to evaluate the success of actions implemented. In conjunction with research, monitoring also will be important for providing data to revise and update biological objectives. Research is particularly essential since most biological objectives are based on limited data and assumptions.”

I. DESIRED FUTURE CONDITION – Open stands of old growth/mature Ponderosa pine.

UNITS 1,3,4,5, and portions of 6, 9 and 8 (Note: Fig 2.1 represents predominant habitats. Within each Unit small acreages of other habitats also exist.)

The following description of desired conditions is from Altman (2000):

“Because of the extensive loss of Ponderosa pine forest, habitat restoration is the most important strategy for conservation of landbirds associated with this habitat type. The desired condition in Ponderosa pine forest is a large tree, single-layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration”

This desired future condition is also the basis for much of the current management of U.S. Forest Service lands adjacent to the Refuge. In addition, the PIF Plan identifies the Wild Horse Ridge area as a Bird Conservation Area because of its large number of mature Ponderosa pines. This area is located immediately south of Unit 9 and east of Units 3 and 5. Thus, restoration of this habitat contributes to the restoration and function of a much larger habitat within the adjacent landscape. This is important because of the relatively large acreage required to support focal bird species (in this case white-headed woodpecker).

Habitat objectives:

1. >10 trees/ac >21 in dbh, and at least 2 of the trees >31 in dbh
2. >1.4 snags/ac >8 in dbh with 50% >25 in dbh in a moderate to advanced state of decay.
3. 20-60% cover in the shrub layer (includes shrubs and small trees) and >20% of the shrub layer in regenerating sapling conifers, especially pines
4. Where appropriate maintain contiguous blocks of 350 (primarily old growth) to 700 acres (mixed old growth and younger stands).
5. Mean canopy cover 10-30%

Wildlife Objectives:

The open condition of historic Ponderosa pine stands is now relatively rare and has led to declines in numerous wildlife species, including deer and elk, in addition to whole guilds of birds. The following narrative briefly describes bird communities within this habitat type (from Altman (2000)):

“We considered approximately 85 native landbird species to be regularly associated breeding species in Ponderosa pine habitats. Several species are

obligate or near obligate to this habitat type such that they are rarely found in other forest types in Oregon and Washington. These include pygmy nuthatch and white-headed woodpecker. Other regularly associated species include flammulated owl, Williamson's sapsucker, Lewis' woodpecker, Townsend's solitaire, chipping sparrow, and white-breasted nuthatch."

Focal bird species for Ponderosa pine with their associated habitat components include:

Species	Habitat Requirements
White-headed woodpecker	Large patches of old forest with large snags
Pygmy nuthatch	Large trees
Chipping sparrow	Open understory with regenerating pines
Bald eagle	Large snags and mature PP near the edge of the marsh
Lewis' woodpecker	Patches of burned old forest

Current Conditions

Ponderosa pine stands on Klamath Marsh NWR have been affected by the following influences:

1. Reduction of old forest stages and large diameter trees and snags from timber harvesting that occurred prior to purchase by the Service.
2. Fire suppression/exclusion has led to declines in characteristic herbaceous and shrub under stories from increased density of small shade-tolerant trees.
3. Density-related stress and associated mortality on old growth ponderosa pine.
4. High fuel loading has increased the risk of unnatural stand replacing wildfires.
5. Fragmentation of remaining tracts negatively impacts species having large area requirements.

Currently, most stands on the Refuge are populated with some remaining large trees, however, encroachment of smaller age trees is intense. At lower elevations near meadow edges, most of this encroachment is lodgepole pine and at higher elevations, small diameter Ponderosa pine has reached unnaturally high densities. These overstocked conditions contribute to a variety of forest health concerns including susceptibility to insect and pathogen outbreaks and stand replacement fire, decrease in individual tree and stand health, decrease in individual tree and stand growth, decrease in shrub and grass/forb diversity and abundance, and competitive pressure on large mature trees. Sustainability of these stands over the long term without serious forest health problems is not a realistic outcome.

Restoration and treatment options:

In addition to restoring historic conditions and associated wildlife habitats, the goal within these stands is to reduce fuel loadings and fire danger, recycle nutrients currently tied up in dead biomass, reduce density-related stress on remnant old growth trees, and re-invigorate grasses and

shrubs by reintroducing fire and/or mechanical treatment to the site. In short, to return these stands to a more open condition dominated by large Ponderosa pine.

Use of commercial and/or non commercial thinning (depending on size of trees to be removed) will be used to bring the stand to the desired condition and then prescribed fire will be used to maintain stand conditions. Even after treatment, most stands on the Refuge would not meet the desired condition due to a lack of large trees, however, the post treatment stand in combination with prescribed fire would allow the desired conditions to develop over time. Restoration treatments (prescriptions) would include:

1. Leave all trees >14^a in dbh (this will ensure the maintenance of the large tree component).
2. Maintain an average of 20 foot spacing between leave trees.
3. Within 100 feet of edge of Klamath Marsh Ponderosa pine spacing would be increased to and average of 40 feet to allow for the growth of large branches and open crowns for roosting bald eagles.
4. First priority of leave trees is the larger Ponderosa pine within each stand.
5. Leave all snags >8 in dbh.
6. Leave scattered ½-2 acre cover clumps.
7. Pile all slash <7 in for burning (in areas of light fuels, slash may simply be scattered and burned).

Depending on stand conditions, the decisions on which trees to leave will be done using 2 methods:

1. Mark all leave trees: This method would involve marking all trees that would remain uncut as part of a contract. Marking crews would be trained as to the spacing, diameter classes, and species priorities prior to marking with oversight from Refuge personnel. This method is relatively expensive but may be appropriate where a substantial numbers of trees in the 7-14 in. dbh range exist and it is important that specific diameter trees and tree species be left after treatment.
2. Contract stipulations: In this case, individual trees would not be marked, rather the species, size classes, and spacing of leave trees would be provided the contractor via contract stipulations. This method is applicable where there are few trees in the 7-14 in dbh range and the leaving of specific trees (<14 in) is relatively unimportant. Unit 4 with its extreme density of small Ponderosa pine is an example of where this treatment option would be applicable.

Slash disposal would also be dependent on stand condition. Where initial stands are dominated by high densities of small trees, hand cutting and piling may be appropriate. Where tree densities are lower, cutting, scattering, and prescribed burning of slash may be more appropriate. Which method to use will be dependent upon fuel loads that will result following treatment.

^a Conifers as small as 14 in. dbh are used as perch sites by bald eagles. Given the importance of Klamath Marsh NWR to nesting and wintering eagles, this element was included in all prescriptions. Examination of conifer stands on the Refuge has revealed very few locations where >14 in dbh conifers exist at densities sufficiently high to lead to deteriorated stand conditions. This may not be the case in other conifer stands that exist in the adjacent landscape.

In a small number of cases, where fuel loads are not excessive, prescribed fire alone may be enough to reduce fuels and densities of small trees sufficient to achieve desired stand conditions. Fuel moisture and environmental conditions would be selected that would achieve the desired effects. Where appropriate this method would tend to reduce the density of small trees particularly those species such as lodgepole pine which are fire intolerant. Suitable conditions for prescribed fire only exist in <10% of existing forest stands on the Refuge.

II. DESIRED FUTURE CONDITION: Old Growth Lodgepole Pine

Most of Unit 2 with the exception of maintenance and restoration of meadows (see section III)

Old growth lodgepole pine in large blocks (>1,000 acres) is important habitat for black-backed woodpeckers as well as elk fawning habitat. Although this habitat has increased by 88% over historic conditions (Wisdom in press.), fragmentation may be limiting block sizes. The only large contiguous old growth lodgepole habitat in the vicinity of Klamath Marsh occurs in the Blue Jay Springs Natural Area and the forest adjacent to Abraham Flat (Unit 2). Detailed habitat components important to black-backed woodpeckers can be found in Altman 2000.

Habitat Objectives:

Large tracts of (>1,000 acres) of lodgepole pine forest dominated by and managed for late successional conditions.

Wildlife Objectives:

The focus would be the black-backed woodpecker and elk fawning habitat, however, other species would benefit from the habitat type including mountain chickadee, yellow-rumped warbler, cassins's finch, pine siskin, and dusky flycatcher. In addition, mule deer use the perimeter of this habitat type for bedding and fawning, as well as escape cover.

Current Conditions:

Unit 2 (Abraham Flat) is the primary area of Klamath Marsh NWR (in combination with the Forest Service's Blue Jay Springs Natural Area that contains a sizable acreage of this habitat type. In low elevation areas adjacent to Abraham Flat, lodgepole pine is extensive with high accumulations of down woody material and a high density of snags. Very low density of Ponderosa pine also exist in this area but are generally <3 in dbh. The prevalence of Ponderosa pine tends to increase as one moves upslope from the Abraham Flat meadow.

Restoration and Treatment Options:

Options for restoration of this habitat to old growth conditions are limited on the Refuge. Currently rather extensive acreage of this habitat exists in the Abraham Flat and Blue Jay Spring

Natural Area. At this time, the Service does not propose to treat old growth stands of lodgepole in the Abraham Flat area other than actions described for meadow restoration (see Section III) and aspen enhancement (see Section IV).

III. DESIRED FUTURE CONDITON: Meadow and Forested Meadow Complexes

Unit 2 and portions of Units 3, 6, 7, and 8 (Note: Fig 2.1 represents predominant habitats. Within each Unit small acreages of other habitats also exist.)

Large (>300 acres) meadow habitats on Klamath Marsh NWR and its vicinity are important feeding and breeding habitat for the greater sandhill crane (GSC). In Oregon, Klamath Marsh NWR represents one of the largest breeding populations of these birds in the State. Over the last 10 years breeding populations of GSCs on the Refuge have ranged from 45-60 pairs. Habitats for sandhill cranes exist adjacent to all upland forested site on the refuge.

The PIF East Slope Cascade Plan (Altman 2000) lists wet/dry meadows as areas of conservation focus and the GSC as the focal species. Conifer encroachment into meadows is evident in all areas of the refuge where meadows and forested habitats meet.

Habitat Objective:

1. Restore and maintain areas of former meadow habitat that have been encroached by conifers (Units 2, 3, 6, and 9).
2. Maximize and maintain forest meadow interspersation (50-70% meadow) in Unit 7 (north) and Unit 8 (east).
3. Create snags near meadow edges via prescribed fire activities. These will predominately be lodgepole >14 in dbh.

Wildlife Objectives:

1. Maximize habitat for breeding GSC as well as common snipe, Lincoln's sparrow, song sparrow, and common yellowthroat (Units 2, 3, 6, and 9).
2. Maximize migration and breeding habitat for neotropical migratory birds (portions of Units 7 and 8).
3. Provide foraging habitats for elk and mule deer near escape cover (Units 2, 3, 6, 7, 8, and 9).
4. Create snags near meadow edges for cavity nesting birds.

Current Conditions:

Lodgepole encroachment into meadow and marsh habitats has been occurring for decades throughout the Klamath Marsh area. In some areas this phenomenon is clearly seen as high densities of small lodgepole extending out from the older forest edges. In other areas such as Abraham Flat, survey maps from the 1890's indicate that conifer encroachment of meadow habitat particularly to the south has completely cut off the connectivity to other meadows currently on Forest Service lands. In addition, what is now closed canopy lodgepole pine

adjacent to meadow habitat still retains remnant patches of grasses and sedges. It is likely that decades of fire suppression has allowed conifers to invade and reduce the acreage of meadow habitats.

Restoration and Treatment Options:

Depending on forest/meadow conditions, there are 3 basic approaches:

1. Meadows with encroaching lodgepole saplings—In this instance which occurs in most meadow edge habitats on Klamath Marsh, fall or spring prescribed fire would be used to kill small saplings and re-invigorate grass and sedge habitats (Units 2, 3, 6, and 9).
2. Encroachment of lodgepole into forest/meadow interspersed habitats--Because of lodgepole pine encroachment that has occurred in Units 7 and 8 and the lack of fine fuels (grasses) to support fire, cutting of trees <4 in may be required to provide sufficient fuels to carry a fire and re-establish and maintain the high degree of meadow/conifer interspersed in this area.
3. Historic meadow habitats replaced by older age lodgepole stands—Under these conditions, commercial and/or non-commercial mechanical harvest/slash treatments would first be conducted to remove the lodgepole pine and reduce woody fuels such that prescribed fire could be used to restore and maintain historic meadow edges. Older lodgepole stands would be treated where remnant grasses or sedges still exist within the forest or where thick layers of organic soils indicate that meadow or marsh occupied the site in the recent past. Under this treatment, trees >14 in would not be removed. These leave trees would likely be targeted by prescribed fire creating valuable snag habitats. This treatment would be applicable to portions of Units 2, 3, 6, and 9.

IV. DESIRED FUTURE CONDITION: Large Aspen Trees and Snags with Regeneration

Portions of Units 2, 3, 4, 5, 6, 7, and 8 (Note: Fig 2.1 represents predominant habitats. Within each Unit small acreages of other habitats also exist.)

This habitat type is listed as a unique conservation focus habitat within the PIF East Slope Cascades Plan (Altman 2000) with the focal bird species being the red-naped sapsucker. Aspen groves on and adjacent to Klamath Marsh NWR exist on the edge of meadows and within both lodgepole and Ponderosa pine habitats.

Habitat Objectives:

Initiate actions in aspen habitat to maintain or provide some areas with natural (e.g, fire) or mechanical disturbance regimes to ensure proper successional development .

1. >10% cover of sapling aspen in the understory to provide adequate representation of younger seral stages for replacement.
2. >4 trees and >1.5/ac >39 ft in height and 10 in dbh.

3. Mean canopy cover 40-80%; either clumped with patches and openings or relatively evenly distributed.

Wildlife Objectives:

1. Red-naped sapsucker
2. Other species to benefit include mule deer, elk, house wren, mountain bluebird, Williamson's sapsucker, tree swallow, northern pygmy owl, western screech owl, and northern flicker.

Current Conditions:

Isolated stands of aspen occur in small patches in nearly all forested areas of the Refuge and at many meadow edges, however, conifer encroachment, fire suppression, and past grazing practices have severely limited recruitment of young trees. Many of the existing stands are in decline with little evidence of new recruitment.

Restoration and or Treatment needs:

Prescribed fire will be used to re-invigorate aspen stands. Selected aspen stands would likely be burned as part of larger burning programs within upland forested habitats. Restoration treatment would include:

1. Clear all conifers < 14 in dbh from within aspen stands
2. Clear all conifers < 14 in dbh within 30 ft of aspen stands
3. Use prescribed fire (spring or fall as appropriate to encourage recruitment of young aspen).

Literature Cited

- Altman, B. 2000. Conservation strategy for landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington, Partners in Flight, Ver. 1.0. American Bird Conservancy, Boring, Oregon.
- Desante, D. 1989. Monitoring avian productivity and survivorship and population levels in the National Parks by a program of constant effort mist-netting during the breeding season. A proposal to the Loomis Museum Association. The Institute for Bird Populations, Point Reyes Station, California
- Rosenstock, S.S. 1996. Habitat relationships of breeding birds in northern Arizona ponderosa pine and pine-oak forests. Arizona Game and Fish Department Technical Report No. 23
- Rotenberry, J.T. 1985. The role of habitat in avian community composition: physiognomy of floristics? *Ecologia* 67:213-217.

Compatibility Determination

Use: Fire Hazard Reduction and Wildlife Habitat Enhancement

Refuge Name: Klamath Marsh National Wildlife Refuge

Establishing and Acquisition Authority(ies):

- Klamath Marsh NWR was established in 1958 under the Migratory Bird Conservation Act. (16 U.S.C. 715-175r).

Refuge Purpose(s):

- "... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "... suitable for – (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. § 460k-1 (Refuge Recreation Act)
- "... the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions ..." 16 U.S.C. § 3901(b), 100 Stat. 3583 (Emergency Wetlands Resource Act of 1986)

National Wildlife Refuge System (NWRS) Mission:

- The mission of the National Wildlife Refuge System is "to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (National Wildlife Refuge System Administration Act of 1966, as amended [16 U.S.C. 668dd-668ee]).

Description of Use:

- The U.S. Fish and Wildlife Service (Service) proposes to reduce the fire hazard consistent with desired upland habitat conditions on up to 3,400 acres in forested and forest/meadow edge habitats of the Klamath Marsh National Wildlife Refuge with manual/mechanical thinning and prescribed fire. Excessive tree densities and large accumulations of down woody fuels have dramatically increased the risk of catastrophic wildfire, which could threaten residences and structures in and adjacent to the refuge. Tree densities within ponderosa pine stands of the Refuge range from 200 - 800 stems/acre (average ~500 stems/acre), with an average basal area of 150 ft²/acre (D. Kilbury, USDA, Forest Service, pers. Comm). Once fuel hazards are reduced, prescribed fire will be used in ponderosa pine forests on a rotational basis to keep fuel loads to acceptable levels, move the stand composition toward more fire tolerant species, and improve wildlife habitat. In addition, decades of fire suppression and timber harvest by previous land owners have left refuge upland habitats in an unnatural state. Fuels treatments and prescribed fire

are management tools required to restore refuge upland habitats to desired conditions (See Attachment 1). For additional details, see Alternative 2 - Implement Thinning and Prescribed Fire Treatments to Reduce Fire Hazard while Enhancing Wildlife Habitats, in the Klamath Marsh National Wildlife Refuge Fire Hazard Reduction and Wildlife Habitat Enhancement Project, Final Environmental Assessment (EA), dated March 21, 2003. Copies are available at www.klamathnwr.org or by writing: Refuge Manager, U.S. Fish and Wildlife Service, 4009 Hill Road, Tulelake, CA 96134. Manual and mechanical thinning projects associated with this action will likely require Service funding on a per acre basis. Any commercially valuable trees removed may reduce the per acre costs of this activity to the Service. As such, this activity is a Refuge management economic activity meaning that it may generate revenues to individual contractors.

Availability of Resources:

- **Needed resources:** Funding for projects covered by the environmental assessment may be available from either wildland urban interface or hazard fuel reduction funds made available through the Service fire management program. Projects will be contracted, so contract administration and unit layout (unit boundary identification, tree marking, GPS) will require refuge personnel.
- **Revenues:** A minimal amount of commercially valuable timber may be harvested during the projects. It is unlikely that significant revenues would be produced as the value of the timber would likely be offset by the costs associated with the projects.
- **Adequacy of existing resources:** Existing resources are adequate to safely and effectively administer the projects.
- **Soliciting outside resources:** Assistance with administering contracts will be solicited from regional Wildland Urban Interface Coordinators.

Anticipated Impacts of the Use:

- Thinning timber stands from below and the use of prescribed fire will reduce the fire hazard on the Klamath Marsh National Wildlife Refuge and help protect the forest stands from loss to catastrophic wildfire. Reducing hazardous fuel loadings will allow for the use of prescribed fire in ponderosa pine forests and move the stand compositions to include more fire-tolerant species. Thinning and prescribed fire in ponderosa pine stands will also promote the development of large diameter trees (old growth). Overall, fuels treatments and prescribed fire are needed on the refuge to enhance upland wildlife habitats and associated wildlife species as described in Attachment 1. Historic fire regimes shaped the community structure and function of forest and meadow habitats in and adjacent to Klamath Marsh NWR. Restoration of this ecological force will restore many of the lost habitat attributes. For additional details of the potential impacts from implementing this action, see Sections 3.1.2.2, 3.2.2.2, 3.3.2.2 ... to 3.11.2.2. in the Klamath Marsh National Wildlife Refuge Fire Hazard Reduction and Wildlife Habitat Enhancement Project, Final Environmental Assessment, dated March 23, 2003.
- It is anticipated that the Service will implement the proposed activities on one to two units per year beginning no sooner than 2005. Prior to implementing activities on a specific unit, the Service will consult under Section 7 of the Endangered Species Act to ensure that potential effects to listed species are avoided or minimized. A map of management units associated with the proposed activity is available as Fig. 2.1 in the Final EA titled Klamath Marsh National

Wildlife Refuge Fire Hazard Reduction and Wildlife Habitat Enhancement Project, dated March 23, 2003.

- Public use (consumptive and non-consumptive uses) of the Refuge access route in Unit 3 (Silver Lake HWY to Wocus Bay) may be temporarily effected when thinning and prescribed fire activities are occurring.

Public Review and Comment:

- Public involvement:
 - A scoping notice describing the proposed action was sent to 47 individuals on November 16, 2001 and was posted in the Klamath Falls Herald and News on November 25, 2001. The scoping comment period ran from November 16, 2001 to December 21, 2001.
 - Copies of the draft EA were mailed to those that participated in project scoping and to other interested parties on June 13, 2002. A legal notice of the availability of the draft EA was published in the Klamath Falls Herald and News on June 14, 2002. Copies were also made available on the Refuge website and at Refuge Headquarters. Comment period for the draft EA was open from June 14, 2002 to July 15, 2002.
 - Numerous meetings were held with the Klamath Tribes regarding the proposed project including October 3, 2001, November 8, 2001, December 11, 2001, February 15, 2002, April 16, 2002, October 1, 2002, November 12, 2002, January 30, 2003, and February 5, 2003. Issues discussed at these meetings included general project information, tribal subsistence resources, and cultural resources.
 - An additional meeting to address comments made by Oregon Natural Resource Council was held November 12 and 13, 2002. The Service, Oregon Natural Resources Council, the Klamath Tribes, Klamath Bird Observatory, and the U.S. Forest Service attended.
- Comments and responses: Fourteen written comments were received during the scoping period. Three written comments were received in response to the draft EA. Significant comments from the scoping period centered on cutting trees over 14 inches diameter breast height (DBH), creating fuel breaks, and impacts to the Klamath Tribe's Treaty resources. The Service response to these comments was to set the upper diameter limit on cut trees at 14 inches DBH, to eliminate the proposal to create fuel breaks, and to implement a series of measures to protect Treaty resources and work cooperatively with the Klamath Tribes to design treatment units and monitor project implementation. Of the three comment letters on the draft EA, two focused primarily on air quality and water quality issues. The third comment letter involved a number of issues, ranging from administrative procedure to proposed treatment prescriptions to potential environmental impacts to adjacent lands. The FWS responded to all the issues in the three comment letters in Appendix A of the Environmental Assessment.

Determination:

☐ Use is Not Compatible

☒ Use is Compatible With Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- During the bald eagle nesting season (January 1 -August 15), fuels treatment activities and prescribed fire will not be allowed within ½ mile of active eagle nests. It is anticipated that the Service will implement the proposed activities on one to two units per year beginning no sooner than 2005. Prior to implementing activities on a specific unit, the Service will consult under Section 7 of the Endangered Species Act to ensure that potential effects to listed species are avoided or minimized. A map of management units associated with the proposed activity is available as Fig. 2.1 in the Final EA titled Klamath Marsh National Wildlife Refuge Fire Hazard Reduction and Wildlife Habitat Enhancement Project, dated March 23, 2003.
- To ensure Tribal subsistence rights are not impacted and cultural resources are protected, the Klamath Tribes will be an integral part of project planning and implementation.
- Backing fires would be used when possible to limit smoke production. All burns would be aggressively mopped-up. Burn prescriptions would be written to minimize the potential for high-intensity fire by avoiding excessively dry and/or high wind conditions.
- To protect mule deer and elk calving and fawning grounds, thinning and prescribed fire activities will be prohibited in these areas between May 15 and July 15. The Service will identify the areas to be avoided during this time frame by consulting with the Oregon Department of Fish and Wildlife and the Klamath Tribes.
- Private contractors will operate under a Service issued Special Use Permit. Permit stipulations will be added such that contractor activities are consistent with all applicable State and Federal laws, Service policy, and the intent of the described action.

Justification:

- Purpose(s) and mission: Use contributes to Refuge purposes and the NWRS mission. Use will restore and maintain forest stands used by a variety of plant and wildlife species. Habitat, plant, and wildlife diversity will increase over time as the natural fire regime is restored the refuge's forested habitats.
- Goals, objectives, and refuge management activities: Use supports goals and objectives of the refuge. The goals of the Klamath Marsh NWR are to manage for the conservation of endangered, threatened, sensitive species and the habitats on which they depend, to provide and enhance habitat for fall and spring migrant waterfowl, to protect native habitats and wildlife representative of the natural biological diversity of the Klamath Basin, and to provide high quality wildlife dependent visitor services which are compatible with refuge purposes and cultural resource protection.

- Public safety: Use will provide for public safety. One goal of the use is to reduce the potential for wildfires to burn into populated areas. Prescribed fires will only be ignited under a prescription that will limit the potential for escape. Burning will be done at times when atmospheric conditions maximize smoke dispersion. Use will improve firefighter safety in the long-term.
- Biological resources: Use benefits biological resources by providing the tools needed to restore, enhance, and maintain, desired wildlife habitats and key species to forested refuge habitats. In addition, use will reduce potential for catastrophic wildfire which would destroy eagle nest trees and reduce mature forest stands. Use will return fire as a component of a fire dependent ecosystem. Thinning and prescribed fire will promote the development of large diameter ponderosa pine trees and improve wildlife and plant habitat and diversity.
- Klamath Tribal treaty rights: Use may impact Klamath Tribes members who hunt during deer season as projects are implemented. Projects will be limited to portions of the refuge at any given time, and deer hunting opportunities will still exist in areas outside of specific project areas. Thinning and prescribed fire have the potential to increase forage opportunities for deer which may enhance deer hunting in the long term.
- Big 6: Public use (consumptive and non-consumptive uses) of the Refuge access route in Unit 3 (Silver Lake HWY to Wocus Bay) may be temporarily effected when thinning and prescribed fire activities are occurring.

Mandatory Re-Evaluation Date:

☐ Mandatory 15-year Re-Evaluation Date (for priority public uses)

☒ Mandatory 10-year Re-Evaluation Date (6/15/2013) (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

___ Categorical Exclusion without Environmental Action Statement

___ Categorical Exclusion and Environmental Action Statement

X Environmental Assessment and Finding of No Significant Impact

___ Environmental Impact Statement and Record of Decision

References Cited:

U.S. Fish and Wildlife Service. 2003. Klamath Marsh National Wildlife Refuge Fire Hazard Reduction and Wildlife Habitat Enhancement Project, Final Environmental Assessment. Klamath Basin National Wildlife Refuge, Tulelake, California, 63 pp.

U.S. Fish and Wildlife Service. 2003. Klamath Marsh National Wildlife Refuge Fire Hazard Reduction and Wildlife Habitat Enhancement Project, Finding of No Significant Impact, . Klamath Basin National Wildlife Refuge, Tulelake, California, 5 pp.

Refuge Determination:

Prepared by: David Mansur 6/16/2003
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: Francis J. Mauri, acting 6/16/03
(Signature) (Date)

Concurrence:

Refuge Supervisor: David G. Paulin 6/25/03
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: Carolyn A. Bohen 6/30/03
(Signature) (Date)

Acting California/Nevada
Operations Manager
(for CA and NV): D. Kern H. M. D. 7-20-03
(Signature) (Date)

Attachment 1.

Desired Upland Habitat Conditions and Treatment/Restoration Options - Klamath Marsh NWR

Background

The Partners in Flight (PIF) East Slope Cascade Mountains Bird Conservation Plan (Oregon and Washington) (Altman 2000) was used in part to develop desired habitat conditions for forested and forest/meadow habitats at Klamath Marsh NWR. This plan outlines management approaches that will increase habitat variability and carrying capacity for numerous wildlife species, promote restoration of forest complexity and forest health, and reduce overall fuel levels and continuity. The PIF Plan describes current habitat conditions, prioritizes habitats for restoration, and identifies focal bird species within the landscape, of which Klamath Marsh NWR is a part. In this instance, focal bird species also serve as indicators of habitat health. Focal bird species identified in the PIF Plan are habitat specialists, meaning they have very specific habitat requirements. Species such as mule deer are habitat generalists, able to use a variety of habitats as long as a few key requirements are met. When robust populations of indicator species are present, habitat generalists tend to benefit as well. Niches for habitat specialists are provided when a variety of habitats exist across the landscape. In addition, habitat generalists benefit to great extent because they are often able to make use of multiple habitats. The following narrative from the PIF Plan describes conditions within this geographic area:

“Vegetation of the East-Slope Cascades has changed in the last 150 years since European settlement of the region. Primary changes have been the loss of old forest habitat due to intensive timber harvesting, and the degradation of habitats (eg., Ponderosa pine forest) from a number of factors including fire suppression, over-grazing, invasion of exotic vegetation, and human development. The loss and alteration of historic vegetation communities has impacted landbird habitats and resulted in species range reduction, population declines, and some local and regional extirpations.”

The following discussion of habitat and wildlife objectives and restoration options is organized around desired future conditions. These desired habitats include open Ponderosa pine, old growth lodgepole, wet and dry meadows, and vigorous aspen stands. In general, treatment units identified in the Environmental Assessment contain or are restorable to one or more of these habitats, thus more than one treatment option may occur in a particular unit. For example, Unit 6 has a meadow edge component that may require spring or fall prescribed fire to set back encroaching lodgepole saplings. Over stocked Ponderosa pine exists at slightly higher elevations that will require thinning, treatment of slash, and prescribed fire, and scattered aspen stands occur throughout that will require some form of disturbance. The following desired conditions and treatment/restoration options were developed using input from the Klamath Tribes, Klamath Bird Observatory, Oregon Natural Resource Council, and the U.S. Forest Service. Treatments in some areas may require modification to protect cultural resources and/or the subsistence rights of the Klamath Tribes. Coordination with the Tribes will be required for successful implementation of treatment/restoration activities.

Restoration to desired future condition will likely result in some short-term impacts. The PIF for the East Slope Cascades captures the essence of this issue:

“Meeting the goal of healthy landbird populations in the East Slope Cascades begins with the maintenance and restoration of functioning forest and non-forest ecosystems.

Currently, considerable emphasis is being placed on restoration of these habitats to some semblance of pre-settlement conditions (approximately 1850). It is important to recognize that habitat alterations during restoration activities may temporarily or permanently displace landbird species currently using those areas. However, most degraded habitats tend to support habitat generalist species that are usually widespread and fairly common and not of high conservation concern. Because of the degree of loss and degradation of most properly functioning ecosystems, restoration in many areas will be a long-term process.”

Monitoring

If funding can be obtained, the Service through cooperators will monitor landbird response to habitat treatments conducted as part of this project. At Klamath Marsh there is a unique opportunity to integrate National Fire Plan objectives with those of the Refuge, and the Service. Management for the desired conditions will result in the reduction of fuel loads and fire danger, and habitat enhancement for fire associated wildlife. By associating current and desired conditions with PIF focal species, bird monitoring can be used to monitor the effectiveness of these treatments within the ecosystem management framework.

When considering the integration of National Fire Plan and Refuge objectives, it is clear that landbird monitoring is a cost-effective and flexible effectiveness monitoring tool. The advantages include that one or two methods effectively monitors a wide range of species, including habitat specialists, rare species, and those with a wide range of adaptations. Because of their rapid metabolism, and generally high position on food webs, landbirds are good indicators of the effects of environmental change (DeSante 1989). Most landbird species are dependent on specific habitat attributes. Habitat alterations, such as those brought about by forest management practices, have considerable potential to affect avian communities (Rosenstock 1996). The effect of management on habitat structure, floristic composition and food resources may be especially important, singly or in combination, as many birds respond strongly to these features in their habitats (Rotenberry 1985).

The PIF calls for monitoring components for Conservation Plan associated projects:

“Monitoring of habitat attributes and focal species will provide a means of tracking progress towards conservation. Monitoring will provide essential feedback for demonstrating adequacy of conservation efforts on the ground, and guide the adaptive management component that is inherent in this approach. When conservation actions are undertaken as described in this document, monitoring and/or research programs should be designed and implemented to test the effectiveness of management actions, evaluate assumptions built into biological objectives, and direct adaptive management to achieve desired results. Monitoring will be essential to evaluate the success of actions implemented. In conjunction with research, monitoring also will be important for providing data to revise and update biological objectives. Research is particularly essential since most biological objectives are based on limited data and assumptions.”

I. DESIRED FUTURE CONDITION – Open stands of old growth/mature Ponderosa pine.

UNITS 1,3,4,5, and portions of 6, 9 and 8 (Note: Fig 2.1 represents predominant habitats. Within each Unit small acreages of other habitats also exist.)

The following description of desired conditions is from Altman (2000):

“Because of the extensive loss of Ponderosa pine forest, habitat restoration is the most important strategy for conservation of landbirds associated with this habitat type. The desired condition in Ponderosa pine forest is a large tree, single-layered canopy with an open, park-like understory dominated by herbaceous cover with scattered shrub cover and pine regeneration”

This desired future condition is also the basis for much of the current management of U.S. Forest Service lands adjacent to the Refuge. In addition, the PIF Plan identifies the Wild Horse Ridge area as a Bird Conservation Area because of its large number of mature Ponderosa pines. This area is located immediately south of Unit 9 and east of Units 3 and 5. Thus, restoration of this habitat contributes to the restoration and function of a much larger habitat within the adjacent landscape. This is important because of the relatively large acreage required to support focal bird species (in this case white-headed woodpecker).

Habitat objectives:

1. >10 trees/ac >21 in dbh, and at least 2 of the trees >31 in dbh
2. >1.4 snags/ac >8 in dbh with 50% >25 in dbh in a moderate to advanced state of decay.
3. 20-60% cover in the shrub layer (includes shrubs and small trees) and >20% of the shrub layer in regenerating sapling conifers, especially pines
4. Where appropriate maintain contiguous blocks of 350 (primarily old growth) to 700 acres (mixed old growth and younger stands).
5. Mean canopy cover 10-30%

Wildlife Objectives:

The open condition of historic Ponderosa pine stands is now relatively rare and has led to declines in numerous wildlife species, including deer and elk, in addition to whole guilds of birds. The following narrative briefly describes bird communities within this habitat type (from Altman (2000)):

“We considered approximately 85 native landbird species to be regularly associated breeding species in Ponderosa pine habitats. Several species are obligate or near obligate to this habitat type such that they are rarely found in other forest types in Oregon and Washington. These include pygmy nuthatch and white-headed woodpecker. Other regularly associated species include flammulated owl, Williamson’s sapsucker, Lewis’ woodpecker, Townsend’s solitaire, chipping sparrow, and white-breasted nuthatch.”

The open condition of historic Ponderosa pine stands is now relatively rare and has led to declines in numerous wildlife species, including deer and elk, in addition to whole guilds of birds. The following narrative briefly describes bird communities within this habitat type (from Altman (2000)):

Focal bird species for Ponderosa pine with their associated habitat components include:

Species	Habitat Requirements
White-headed woodpecker	Large patches of old forest with large snags
Pygmy nuthatch	Large trees
Chipping sparrow	Open understory with regenerating pines
Bald eagle	Large snags and mature PP near the edge of the marsh
Lewis' woodpecker	Patches of burned old forest

Current Conditions

Ponderosa pine stands on Klamath Marsh NWR have been affected by the following influences:

1. Reduction of old forest stages and large diameter trees and snags from timber harvesting that occurred prior to purchase by the Service.
2. Fire suppression/exclusion has led to declines in characteristic herbaceous and shrub understories from increased density of small shade-tolerant trees.
3. Density-related stress and associated mortality on old growth ponderosa pine.
4. High fuel loading has increased the risk of unnatural stand replacing wildfires.
5. Fragmentation of remaining tracts negatively impacts species having large area requirements.

Currently, most stands on the Refuge are populated with some remaining large trees, however, encroachment of smaller age trees is intense. At lower elevations near meadow edges, most of this encroachment is lodgepole pine and at higher elevations, small diameter Ponderosa pine has reached unnaturally high densities. These overstocked conditions contribute to a variety of forest health concerns, including susceptibility to insect and pathogen outbreaks and stand replacement fire, decrease in individual tree and stand health, decrease in individual tree and stand growth, decrease in shrub and grass/forb diversity and abundance, and competitive pressure on large mature trees. Sustainability of these stands over the long term without serious forest health problems is not a realistic outcome.

Restoration and treatment options:

In addition to restoring historic conditions and associated wildlife habitats, the goal within these stands is to reduce fuel loadings and fire danger, recycle nutrients currently tied up in dead biomass, reduce density-related stress on remnant old growth trees, and re-invigorate grasses and shrubs by reintroducing fire and/or mechanical treatment to the site. In short, to return these stands to a more open condition dominated by large Ponderosa pine.

Use of commercial and/or non commercial thinning (depending on size of trees to be removed) will be used to bring the stand to the desired condition and then prescribed fire will be used to maintain stand conditions. Even after treatment, most stands on the Refuge would not meet the desired condition due to a lack of large trees, however, the post treatment stand in combination with prescribed fire would allow the desired conditions to develop over time. Restoration treatments (prescriptions) would include:

1. Leave all trees >14 in dbh^a (this will ensure the maintenance of the large tree component).
2. Maintain an average of 20 foot spacing between leave trees.
3. Within 100 feet of edge of Klamath Marsh Ponderosa pine spacing would be increased to an average of 40 feet to allow for the growth of large branches and open crowns for roosting bald eagles.
4. First priority of leave trees is the larger Ponderosa pine within each stand.
5. Leave all snags >8 in dbh.
6. Leave scattered ½-2 acre cover clumps.
7. Pile all slash <7 in for burning (in areas of light fuels, slash may simply be scattered and burned).

Depending on stand conditions, the decisions on which trees to leave will be done using 2 methods:

1. Mark all leave trees: This method would involve marking all trees that would remain uncut as part of a contract. Marking crews would be trained as to the spacing, diameter classes, and species priorities prior to marking with oversight from Refuge personnel. This method is relatively expensive but may be appropriate where a substantial numbers of trees in the 7-14 in. dbh range exist and it is important that specific diameter trees and tree species be left after treatment.
2. Contract stipulations: In this case, individual trees would not be marked, rather the species, size classes, and spacing of leave trees would be provided the contractor via contract stipulations. This method is applicable where there are few trees in the 7-14 in dbh range and the leaving of specific trees (<14 in) is relatively unimportant. Unit 4 with its extreme density of small Ponderosa pine is an example of where this treatment option would be applicable.

Slash disposal would also be dependent on stand condition. Where initial stands are dominated by high densities of small trees, hand cutting and piling may be appropriate. Where tree densities are lower, cutting, scattering, and prescribed burning of slash may be more appropriate. Which method to use will be dependent upon fuel loads that will result following treatment.

In a small number of cases, where fuel loads are not excessive, prescribed fire alone may be enough to reduce fuels and densities of small trees sufficient to achieve desired stand conditions. Fuel moisture and environmental conditions would be selected that would achieve the desired effects. Where appropriate this method would tend to reduce the density of small trees particularly those species such as lodgepole pine which are fire intolerant. Suitable conditions for prescribed fire only exist in <10% of existing forest stands on the Refuge.

II. DESIRED FUTURE CONDITION: Old Growth Lodgepole Pine

Most of Unit 2 with the exception of maintenance and restoration of meadows (see section III)

Old growth lodgepole pine in large blocks (>1,000 acres) is important habitat for black-backed woodpeckers as well as elk fawning habitat. Although this habitat has increased by 88% over historic conditions (Wisdom in press.), fragmentation may be limiting block sizes. The only large contiguous old growth lodgepole habitat in the vicinity of Klamath Marsh occurs in the Blue Jay Springs Natural Area

^a Conifers as small as 14 in. dbh are used as perch sites by bald eagles. Given the importance of Klamath Marsh NWR to nesting and wintering eagles, this element was included in all prescriptions. Examination of conifer stands on the Refuge has revealed very few locations where >14 in dbh conifers exist at densities sufficiently high to lead to deteriorated stand conditions. This may not be the case in other conifer stands that exist in the adjacent landscape.

and the forest adjacent to Abraham Flat (Unit 2). Detailed habitat components important to black-backed woodpeckers can be found in Altman 2000.

Habitat Objectives:

Large tracts of (>1,000 acres) of lodgepole pine forest dominated by and managed for late successional conditions.

Wildlife Objectives:

The focus would be the black-backed woodpecker and elk fawning habitat, however, other species would benefit from the habitat type including mountain chickadee, yellow-rumped warbler, cassins's finch, pine siskin, and dusky flycatcher. In addition, mule deer use the perimeter of this habitat type for bedding and fawning, as well as escape cover.

Current Conditions:

Unit 2 (Abraham Flat) is the primary area of Klamath Marsh NWR (in combination with the Forest Service's Blue Jay Springs Natural Area that contains a sizable acreage of this habitat type. In low elevation areas adjacent to Abraham Flat, lodgepole pine is extensive with high accumulations of down woody material and a high density of snags. Very low density of Ponderosa pine also exist in this area but are generally <3 in dbh. The prevalence of Ponderosa pine tends to increase as one moves upslope from the Abraham Flat meadow.

Restoration and Treatment Options:

Options for restoration of this habitat to old growth conditions are limited on the Refuge. Currently rather extensive acreage of this habitat exists in the Abraham Flat and Blue Jay Spring Natural Area. At this time, the Service does not propose to treat old growth stands of lodgepole in the Abraham Flat area other than actions described for meadow restoration (see Section III) and aspen enhancement (see Section IV).

III. DESIRED FUTURE CONDITION: Meadow and Forested Meadow Complexes

Unit 2 and portions of Units 3, 6, 7, and 8 (Note: Fig 2.1 represents predominant habitats. Within each Unit small acreages of other habitats also exist.)

Large (>300 acres) meadow habitats on Klamath Marsh NWR and its vicinity are important feeding and breeding habitat for the greater sandhill crane (GSC). In Oregon, Klamath Marsh NWR represents one of the largest breeding populations of these birds in the State. Over the last 10 years breeding populations of GSCs on the Refuge have ranged from 45-60 pairs. Habitats for sandhill cranes exist adjacent to all upland forested site on the refuge.

The PIF East Slope Cascade Plan (Altman 2000) lists wet/dry meadows as areas of conservation focus and the GSC as the focal species. Conifer encroachment into meadows is evident in all areas of the refuge where meadows and forested habitats meet.

Habitat Objective:

1. Restore and maintain areas of former meadow habitat that have been encroached by conifers (Units 2, 3, 6, and 9).
2. Maximize and maintain forest meadow interspersions (50-70% meadow) in Unit 7 (north) and Unit 8 (east).
3. Create snags near meadow edges via prescribed fire activities. These will predominately be lodgepole >14 in dbh.

Wildlife Objectives:

1. Maximize habitat for breeding GSC as well as common snipe, Lincoln's sparrow, song sparrow, and common yellowthroat (Units 2, 3, 6, and 9).
2. Maximize migration and breeding habitat for neotropical migratory birds (portions of Units 7 and 8).
3. Provide foraging habitats for elk and mule deer near escape cover (Units 2, 3, 6, 7, 8, and 9).
4. Create snags near meadow edges for cavity nesting birds.

Current Conditions:

Lodgepole encroachment into meadow and marsh habitats has been occurring for decades throughout the Klamath Marsh area. In some areas this phenomenon is clearly seen as high densities of small lodgepole extending out from the older forest edges. In other areas such as Abraham Flat, survey maps from the 1890's indicate that conifer encroachment of meadow habitat particularly to the south has completely cut off the connectivity to other meadows currently on Forest Service lands. In addition, what is now closed canopy lodgepole pine adjacent to meadow habitat still retains remnant patches of grasses and sedges. It is likely that decades of fire suppression has allowed conifers to invade and reduce the acreage of meadow habitats.

Restoration and Treatment Options:

Depending on forest/meadow conditions, there are 3 basic approaches:

1. Meadows with encroaching lodgepole saplings—In this instance which occurs in most meadow edge habitats on Klamath Marsh, fall or spring prescribed fire would be used to kill small saplings and re-invigorate grass and sedge habitats (Units 2, 3, 6, and 9).
2. Encroachment of lodgepole into forest/meadow interspersed habitats--Because of lodgepole pine encroachment that has occurred in Units 7 and 8 and the lack of fine fuels (grasses) to support fire, cutting of trees <4 in may be required to provide sufficient fuels to carry a fire and re-establish and maintain the high degree of meadow/conifer interspersions in this area.
3. Historic meadow habitats replaced by older age lodgepole stands—Under these conditions, commercial and/or non-commercial mechanical harvest/slash treatments would first be conducted to remove the lodgepole pine and reduce woody fuels such that prescribed fire could be used to restore and maintain historic meadow edges. Older lodgepole stands would be treated where remnant grasses or sedges still exist within the forest or where thick layers of organic soils indicate that meadow or marsh occupied the site in the recent past. Under this treatment, trees >14 in would not be removed. These large trees would likely be targeted by prescribed fire creating valuable snag habitats. This treatment would be applicable to portions of Units 2, 3, 6, and 9.

IV. DESIRED FUTURE CONDITION: Large Aspen Trees and Snags with Regeneration

Portions of Units 2, 3, 4, 5, 6, 7, and 8 (Note: Fig 2.1 represents predominant habitats. Within each Unit small acreages of other habitats also exist.)

This habitat type is listed as a unique conservation focus habitat within the PIF East Slope Cascades Plan (Altman 2000) with the focal bird species being the red-naped sapsucker. Aspen groves on and adjacent to Klamath Marsh NWR exist on the edge of meadows and within both lodgepole and Ponderosa pine habitats.

Habitat Objectives:

Initiate actions in aspen habitat to maintain or provide some areas with natural (e.g, fire) or mechanical disturbance regimes to ensure proper successional development .

1. >10% cover of sapling aspen in the understory to provide adequate representation of younger seral stages for replacement.
2. >4 trees and >1.5/ac >39 ft in height and 10 in dbh.
3. Mean canopy cover 40-80%; either clumped with patches and openings or relatively evenly distributed.

Wildlife Objectives:

1. Red-naped sapsucker
2. Other species to benefit include mule deer, elk, house wren, mountain bluebird, Williamson's sapsucker, tree swallow, northern pygmy owl, western screech owl, and northern flicker.

Current Conditions:

Isolated stands of aspen occur in small patches in nearly all forested areas of the Refuge and at many meadow edges, however, conifer encroachment, fire suppression, and past grazing practices have severely limited recruitment of young trees. Many of the existing stands are in decline with little evidence of new recruitment.

Restoration and or Treatment needs:

Prescribed fire will be used to re-invigorate aspen stands. Selected aspen stands would likely be burned as part of larger burning programs within upland forested habitats. Restoration treatment would include:

1. Clear all conifers < 14 in dbh from within aspen stands
2. Clear all conifers < 14 in dbh within 30 ft of aspen stands
3. Use prescribed fire (spring or fall as appropriate to encourage recruitment of young aspen.

Literature Cited

- Altman, B. 2000. Conservation strategy for landbirds of the East-Slope of the Cascade Mountains in Oregon and Washington, Partners in Flight, Ver. 1.0. American Bird Conservancy, Boring, Oregon.
- Desante, D. 1989. Monitoring avian productivity and survivorship and population levels in the National Parks by a program of constant effort mist-netting during the breeding season. A proposal to the Loomis Museum Association. The Institute for Bird Populations, Point Reyes Station, California
- Rosenstock, S.S. 1996. Habitat relationships of breeding birds in northern Arizona ponderosa pine and pine-oak forests. Arizona Game and Fish Department Technical Report No. 23
- Rotenberry, J.T. 1985. The role of habitat in avian community composition: physiognomy of floristics? *Ecologia* 67:213-217.